THE FOUNDRY

Registered U. S. Patent Office

Volume 53
Number 3

CLEVELAND, OHIO, FEBRUARY 1, 1925

Published Semimonthly

Castings Decorate Quality Office Fixtures

MODERN business is demanding more sumptuous office furniture and greater beauty in detail. Consequently more brass and bronze ornamental castings are used on the better grades. Foundry products found on various office fixtures, includes brass and bronze drawer pulls, locks, ferrules for

Beautiful Office of the Chairman of the Board of Directors of the Union Trust Co., Cleveland

desks and chairs, pulls for filing cabinet drawers, hooks on costumers, book ends, ink stand racks and lamp bases. Ferrous castings are used for swivel screws, swivel brackets and in many types of swivel chairs the seat brackets are cast. Cuspidors are weighted with castings. The value of office and store furniture manufactured in 1919, the last year reported by the department of commerce, bureau of census, was $67,394,194, while the amount spent for materials was $29,538,919.

Find Where Castings Can Be Sold

CONTENTS

Self Starting Sales Ideas Never Overload Providence 91

Trademarks Prove Effective Pulling Repeat Orders—By Frank G. Steinebach 93

French and American Iron Foundry Methods Compared—By William Ruddy 97

Reducing Costs on Soil Pipe—By R. E. Nelles. 100

Refining Metals Electrically—By Larry J. Barton 103

Bill Speculates on Universal Ignorance—By Pat Dwyer 108

Charge Cupolas Mechanically 111

Foundry Lighting in the Early Days—By Robert E. Masters 113

British May Build Cast Iron Houses—By Joseph Horton 115

Reclaiming Molding Sand—By F. L. Wolf and A. A. Grubb 116

High Frequency Melting—By Dudley Willcox. 120

Patternmaker Uses Chisel Constantly—By Walter C. Ewalt 122

How and Why in Brass Founding—By Charles Vickers 114

Milestones in Foundry Progress 125

The Shakeout 126

Trade Outlook in the Foundry Industry 127

Comings and Goings of Foundrymen 128

Obituary 129

Equipment Market 132

What the Foundries Are Doing 133

New Trade Publications 134

PUBLISHED BY THE PENTON PUBLISHING CO., CLEVELAND, O.

BRANCH OFFICES

BOSTON.....426 Old South Bldg.
CHICAGO.....1147 People's Gas Bldg.
CINCINNATI .....408 Edwards Bldg.
NEW YORK.....2203-2206 No. 220 Broadway
PITTSBURGH.....2148-49 Oliver Bldg.
SAN FRANCISCO.....675 Monadnock Bldg.
WASHINGTON, D. C.....84 Home Life Bldg.

FOREIGN OFFICES

BIRMINGHAM, ENGLAND.....Prince's Chambers
LONDON, ENGLAND, 2-3 Caxton House, Westminster, S.W.1
PARIS, FRANCE .....23 Rue de la Bienfaisance VIIIe

Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico.....$3.00 a year
Canada .....$4.00 a year
Great Britain and other Foreign Countries.....£1:0:0 a year
Single Copies .....25 cents

Copies published three months or more previous to date of current issue, 50 cents each

Member, Audit Bureau of Circulations, Associated Business Papers, Inc., National Publishers Association

Entered at the Post Office at Cleveland as Second Class Matter

Copyright 1925 by The Penton Publishing Co.

THE FOUNDRY

Registered U. S. Patent Office

Volume 53
Number 3

CLEVELAND, OHIO, FEBRUARY 1, 1925

Published Semimonthly

Castings Decorate Quality Office Fixtures

MODERN business is demanding more sumptuous office furniture and greater beauty in detail. Consequently more brass and bronze ornamental castings are used on the better grades. Foundry products found on various office fixtures, includes brass and bronze drawer pulls, locks, ferrules for

Beautiful Office of the Chairman of the Board of Directors of the Union Trust Co., Cleveland

desks and chairs, pulls for filing cabinet drawers, hooks on costumers, book ends, ink stand racks and lamp bases. Ferrous castings are used for swivel screws, swivel brackets and in many types of swivel chairs the seat brackets are cast. Cuspidors are weighted with castings. The value of office and store furniture manufactured in 1919, the last year reported by the department of commerce, bureau of census, was $67,394,194, while the amount spent for materials was $29,538,919.

Find Where Castings Can Be Sold

CONTENTS

Self Starting Sales Ideas Never Overload Providence 91

Trademarks Prove Effective Pulling Repeat Orders—By Frank G. Steinebach 93

French and American Iron Foundry Methods Compared—By William Ruddy 97

Reducing Costs on Soil Pipe—By R. E. Nelles. 100

Refining Metals Electrically—By Larry J. Barton 103

Bill Speculates on Universal Ignorance—By Pat Dwyer 108

Charge Cupolas Mechanically 111

Foundry Lighting in the Early Days—By Robert E. Masters 113

British May Build Cast Iron Houses—By Joseph Horton 115

Reclaiming Molding Sand—By F. L. Wolf and A. A. Grubb 116

High Frequency Melting—By Dudley Willcox. 120

Patternmaker Uses Chisel Constantly—By Walter C. Ewalt 122

How and Why in Brass Founding—By Charles Vickers 114

Milestones in Foundry Progress 125

The Shakeout 126

Trade Outlook in the Foundry Industry 127

Comings and Goings of Foundrymen 128

Obituary 129

Equipment Market 132

What the Foundries Are Doing 133

New Trade Publications 134

PUBLISHED BY THE PENTON PUBLISHING CO., CLEVELAND, O.

BRANCH OFFICES

BOSTON.....426 Old South Bldg.
CHICAGO.....1147 People's Gas Bldg.
CINCINNATI .....408 Edwards Bldg.
NEW YORK.....2203-2206 No. 220 Broadway
PITTSBURGH.....2148-49 Oliver Bldg.
SAN FRANCISCO.....675 Monadnock Bldg.
WASHINGTON, D. C.....84 Home Life Bldg.

FOREIGN OFFICES

BIRMINGHAM, ENGLAND.....Prince's Chambers
LONDON, ENGLAND, 2-3 Caxton House, Westminster, S.W.1
PARIS, FRANCE .....23 Rue de la Bienfaisance VIIIe

Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico.....$3.00 a year
Canada .....$4.00 a year
Great Britain and other Foreign Countries.....£1:0:0 a year
Single Copies .....25 cents

Copies published three months or more previous to date of current issue, 50 cents each

Member, Audit Bureau of Circulations, Associated Business Papers, Inc., National Publishers Association

Entered at the Post Office at Cleveland as Second Class Matter

Copyright 1925 by The Penton Publishing Co.

Trademarks Prove Effective Pulling Repeat Orders

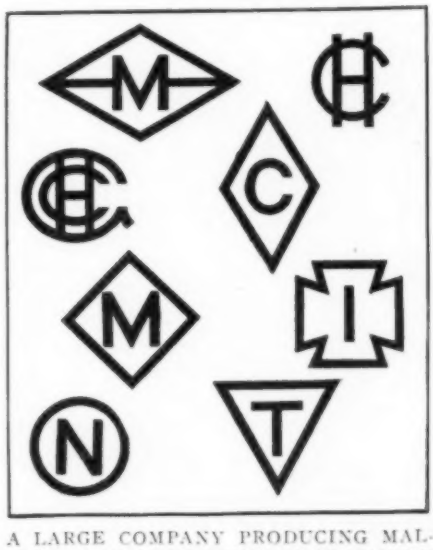
Frank G. Steinebach

WHAT single factor has been of greatest assistance in building the large business enterprises of today, where national and international distribution is enjoyed and the yearly volume of business assumes a staggering total? How have many manufacturers created a clear distinction between their products and other similar makes to the extent that the customer invariably will call for their product, providing the quality of the goods is comparable? If you were in New York and found it necesary to make a quick trip to Chicago, does not the *Century* come to your mind first, although railroads other than the New York Central lines run crack trains between the two cities? If you have a little tickle in your throat, do you not think of the Smith Bros., Trade and Mark?

The judicious use of a well-selected trademark or tradename has been the constructive force back of practically all of the large manufacturing enterprises of today and has been paramount in making such successes as *Ivory* soap, *Gold Medal* flour, *Royal* baking powder, *Keen Kutter* tools, and thousands of others. Over a long period, depending on the efforts of the manufacturer, the buying public has come to associate these names with the products and will use the trademark in buying the merchandise. Generalities have been excluded in the successful selling of commodities today. The buying public has been educated to the value of buying quality products sold under known trademarks and will not be satisfied with substitutes. They fear that the quality may not be as high in unnamed goods. Is not the same attitude possible among buyers of castings? Can it not be cultivated?

Use of the trademark as an aid to selling is not new, for such was the practice among the ancients, even before the time of a written language. Pieces of pottery which were made in Egypt more than 4000 years ago, have been discovered carrying a trademark in the form of an irregular triangle stamped on the back. It also is believed that the Chinese made use of the symbol as a means of distinguishing makes of pottery even before this time. The first use of the trademark in the modern way began in the fourteenth century, when the manufacturers of paper discovered the method of placing the watermark on paper without interfering in any way with its usefulness. Some of the standard paper sizes today are designated by the names carried on the watermarks several hundred years ago.

The growth and many ramifications of manufacturing enterprises have necessitated some way of identifying the maker, so that the buyer can be assured of obtaining merchandise of his liking, can have some assurance as to the quality of the goods, the carefulness of selection, the purity of ingredients, and the correctness of weight and measure. Several centuries ago, before the day of quick communication and rapid means of transportation, before the railroad and the steamboat were conceived, each community formed a self-contained industrial center. Large manufacturing centers were unknown and the necessities of life were grown nearby or made within the community. The miller ground the grain into flour, the shoemaker made the shoes to order, and the smithy formed the tools. The customer went to the mill to get the meal and to the shop to buy the shoes and tools. As long as this condition existed there was no need for any mark to identify the maker, for the customer knew the reputation of the miller, the shoemaker, and the smithy and was sure of the quality of the product.



A LARGE COMPANY PRODUCING MALLEABLE CASTINGS USES SYMBOLS TO DISTINGUISH THE PRODUCTS OF ITS EIGHT DIFFERENT PLANTS SCATTERED THROUGHOUT THE COUNTRY

In time the small communities grew and people moved from one place to another. The reputation of the miller, shoemaker and the smithy had spread, so that the demand was increased and the shops enlarged. The customer now found it impossible to go to the factory to secure the flour, shoes or tools, so the system of retail distribution sprang up. However, some means of identification was necessary to protect the buyer. The maker of the product started to place some distinguishing mark on the goods. At first it was customary to use the mark hung on the sign in front of the place of business, since this already was associated with the manufacturer. Thus, the first common trademarks were associated closely in the buyers' mind with the place where the goods were made.

What is the accepted meaning of the trademark?

It is a distinctive name, word, mark, emblem, design, symbol or device adopted by a tradesman or manufacturer and attached to or stamped upon his goods in some manner for the purpose of identification by the public and protection against the sale of fraudulent imitations.

Not only is the trademark a symbol of

the product, but it also stands for the manufacturer and all that is behind the manufactured product. It stands for a built up reputation and is the connecting link between the ultimate consumer and the manufacturer. Once established, it maintains the identity of the merchandise. The manufacturer of a quality product finds it productive of repeat orders and a builder of greater profits. A trademark represents good will, perhaps the most valuable part of any establishment, and the value of this good will may be measured in its ability to secure orders. Foundrymen all are dependent upon this good will element in these days of intense competition.

Great care must be exercised in the selection of a proper trademark, lest the distinguishing mark become a hindrance rather than a help. Many factors enter into the make up of a good trademark, and while the field in which the mark is to be used largely governs the selection, some points may be considered applicable to any line of merchandise.

The trademark should be simple in design.

Complicated designs are hard to remember and the average person will make little effort to form a mental picture of any great amount of detail.

The trademark should be easy to understand and remember.

When a tradename is used it should be easy to speak and spell. Selecting foreign names often builds a barrier that must be overcome, sometimes at heavy expense, since the American will shy off from pronouncing a name from a language with which he is not familiar. The name *Bon Ami* is an example of this factor, and while the name now is successful in selling the product, the success has been attained at a cost much greater than would have been necessary had a simpler name been selected.

The trademark should be easy to illustrate strikingly, different from other trademarks used on competing lines, and should suggest the good qualities in the merchandise.

Few trademarks conform to all of these factors, but many retain several desirable qualities. Often beautiful designs are selected with blending colors pleasing to the artistic eye, but basicly poor trademarks, being incapable of reproduction in a wide variety of forms without having the chief characteristics impaired.

A trademark similar in design to another appearing on a competing line seldom is successful, since the manufacturer of the product first in the field has the advantage of an established reputation and should continue to find his product in demand, providing the quality is high. The trademark should be of a nature that will not go out of style readily, or come to misrepresent the product. An example of this is the dog and horn representing the Victor Talking Machine Co. Much imagination would be necessary to consider this trademark as representing the beautiful product of that company today.

What particular advantage has the trademark to the jobbing foundryman, or to any maker of castings? Can the same fundamentals which have brought marked achievement in other lines of manufacture find a place in the sales efforts of the maker of castings?

Since quality is of first consideration in selling castings, and since this factor governs repeat orders largely, some connecting link between the foundryman and the user is necessary for reasons already explained. The trademark may be made of great value to the foundrymen, the value depending on the selection and method of use.

Surely the example set by the manufacturers of foundry supplies and equipment in selling their products under a trademark or tradename should point the way to greater possibilities in the castings sales. If it is a molding machine, a sand mixer, a core oven, a cupola, flasks, parting compounds, pig iron, coke, sand or practically anything used in the foundry, a trademark designates the maker and guarantees the quality.

Numerous foundries now sell their product bearing a trademark. The foundryman who is trying to get repeat orders can see the benefit that may be derived

The Circle, Triangle, and Square with the Initials of the Company Are Used Extensively As Trademarks For Castings

Not All Manufacturers Have a Name so Easily Symbolized as Bell, But the Company Name Makes a Good Trademark

SEVERAL GROUPS OF CASTING MANUFACTURERS IDENTIFY PRODUCTS OF THEIR MEMBERS BY ASSOCIATION TRADEMARKS

from having each casting carry some design to distinguish it from the others in the field. The buyer will order castings with which he is familiar, and the average person does not find it convenient to remember firm names, but finds it easier to connect a tradename or design with the product. It also is true that there is something about an attractive design that is tremendously more impressive than any name. It tells a complete story at a glance, and since most people possess a poor memory for names but a good memory for faces, the mental picture of the design should remain fixed. Vision is the most dependable basis of memory.

While many foundrymen have only a vague notion as to the value of the trademark and do not realize that it may be made an efficient producer of orders, others have adopted a mark under which their products are advertised and marketed. A number of trademarks now in use are shown in the accompanying illustrations which are grouped in various classifications.

One of the well known trade marks used by makers of castings is that employed by the members of the National Malleable Castings association. This carries a seal of the association on the left side and bears the inscription "Certified Malleable Castings" as shown on page

A NUMBER OF MANUFACTURERS HAVE BROKEN AWAY FROM THE CONVENTIONAL AND WORKED OUT DESIGNS POSSESSING THE ATTRIBUTES OF A GOOD TRADEMARK, WHILE OTHERS PICK MARKS THAT WILL BE HARD TO REPRODUCE ON THE CASTINGS

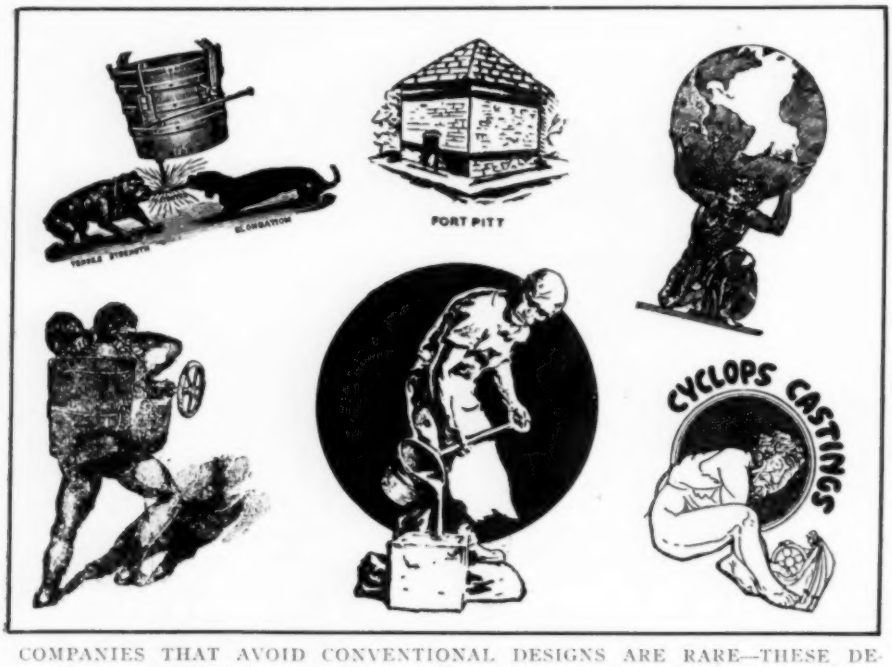
94. In addition to using the trademark of the association, the members have a symbol designating the particular plant at which the castings are made. Another organization trademark is that used by the Electric Steel Founders' Research group. This design shows an open book with "Electric Steel Founders Research Group" written across both pages, while a burning candle is shown over the top.

Trademarks of the products of foundries must be simple, since it is difficult to reproduce complicated designs on castings. In the main this has been considered by the foundrymen in selecting the trademarks, as shown in the illustrations, although a few are rather hard to reproduce on the castings. Since these are complicated, some other method must be used, such as painting on the casting or using tags on which the trademark has been printed. This practice is not as good as having the trademark an integral part of the casting, for it is easier to destroy or lose anything that simply is attached.

A multiplicity of ideas are used in the designs and symbols now in use. A majority of the designs have the name or initials of the company included in some manner. This is good practice since it assists in associating the company with the trademark. Some of the initials are shown in a simple and legible manner, while others are used in the form of a complicated monogram, the individual letters being hard to distinguish. The latter does not make an ideal trademark since it violates several of the essential points previously mentioned.

Drawings of various figures are used, those shown in the illustrations including Atlas holding the world; *Cyclops;* a man holding a large ladle; two dogs standing under a ladle pulling on a bar, one dog being an English bull representing tensile strength and the other a dachshund, showing elongation; and a sketch of Fort Pitt. Several of these designs are good, for they reflect in some way the features of the product.

The geographical location appears to have little bearing on the design selected for a trade mark of foundry products except in the state of Pennsylvania. Here the keystone, the emblem of the state, is used as a background with the initials or name of the company formed in the design. However, the use of the keystone is not limited to that state, and it serves well as a trademark since it is emblematical of strength. The only danger lies in too many foundries using one design, resulting in confusion.



COMPANIES THAT AVOID CONVENTIONAL DESIGNS ARE RARE—THESE DESIGNS SHOW LOCATION OR QUALITY OF PRODUCT

Unless the product is sold nationally, registration is of little value. An article bearing a trademark must be sold in interstate trade or at least outside of the state where it originates before the patent office will accept the mark for registration.

The trademark has been a great help in merchandising products in every line in which it has been employed. While its greatest use has developed in connection with selling commodities appealing to the general public, many manufacturers gunning for sales among a limited class have not been slow to adopt it. This is true not only of the manufactures of foundry supplies and equipment, but in various specialized lines as may be ascertained by examining the advertising sections of business and trade papers circulated in any field.

Although the foundryman in many cases has selected a trademark to represent his product, he neglects to build prestige by using it whenever possible. Less than one-half the advertisers of castings have the trademark appearing in the display and many who do, have the mark secluded in some corner where it is almost inconspicuous or buried in the reading matter where it will not be noticed. Only one foundryman in four has his trademark on his letterhead.

The trademark will not reach its greatest power as a producer of repeat orders unless the design is stamped on the product. The manufacturer who builds a reputation for his trade mark and then fails to place it prominently on the commodity depreciates the value of his mark, for the buying public is skeptical and will not believe the merchandise genuine unless it bears the mark distinguishing the maker. The method of placing the trademark on castings is demonstrated by manufacturers of valves. The Crane Co. places the *swastika* in addition to the name *Crane* on each valve and Jenkins Bros. use the *diamond* and the name *Jenkins.*

The trademark can gain power only through constant use. If it is worth having, it is worth using on every possible occasion. The trademark which is a common word in the vocabulary of every person has not become popular through accident, but has required years of constant effort and the knowledge that a good trademark, known to the public, is a great asset to any business.

Pictures Equipment for Handling Materials

The C. O. Bartlett & Snow Co., Cleveland, has issued a booklet entitled "Recent Installations", which covers mechanical sand handling equipment, mechanical carrying equipment and continuous molding equipment. The entire booklet is composed of reproductions of photographs showing working conditions and methods in foundries where equipment has been installed. The plants listed include the National Car Wheel Co., Rochester, N. Y.; the Saginaw Products Co., Saginaw, Mich.; the Wilson Foundry & Machine Co., Pontiac, Mich.; the Griffin Wheel Co., Detroit; the Wolff Mfg. Corp., Chicago; the Neptune Meter Co., Long Island City, N. Y.; the Lima Locomotive Works, Lima, O.; the Baldwin Locomotive Works, Philadelphia and the Ajax Iron Works, Corry, Pa. The booklet is interesting and should give an excellent idea of material handling methods in the plants mentioned.

French and American Iron Foundry Methods Compared

By

William Ruddy

WHEN Andre Citroen who occupies the same relative position in the automobile world in Europe that Henry Ford does in America, decided to erect and equip a new foundry plant in Paris he engaged the services of William Ruddy to install American equipment and methods. Mr. Ruddy recently has closed his engagement and returned to the United States. His description of foundry conditions, materials and methods and the comparison he draws between those factors in French and American foundries are extremely interesting.

During his stay of 18 months in France he visited all the principal foundry centers, tested and worked with all kinds of sand and iron, installed American molding machines and green sand methods of molding in the Citroen foundry, established a piece work system and so far as possible operated the shop on American lines.

Mr. Ruddy is a member of the American Society of Mechanical Engineers and has had 20 years practical engineering foundry experience. He has been foundry engineer with the Stanley G. Flagg Co., Pottstown, Pa., and with the Walter A. Wood Mowing & Reaping Machine Co., Hoosick Falls, N. Y. He has had malleable foundry experience as plant engineer and metallurgist with the Timken Detroit Axle Co., Canton, O. He served for two years in the ordnance department of the United States army on production and inspection of castings. After the war he superintended the erection and equipment of a foundry in Toronto, Ont., for the Grinnel Co. Canada, Ltd., and had served in the capacity of foundry superintendent for three years when he resigned to accept the position of foundry expert with Andre Citroen with offices and works at 143 Quai de Javel, Paris.

ONE may purchase in Paris a 5-horsepower automobile for approximately 12,000 francs; at least such was the case when the franc was worth 5c. This price was equal to $600 and for a 10-horsepower car, one would pay 18,000 francs, or $900. The French manufacturer sells a product at a much higher price than would be charged in America for the same or much superior article, and has a labor cost not exceeding 20 to 25 per cent of the American. However, this is not all profit, as he generally has two to three times as many men on his payroll as would be required in America, and the interest charges on his plant possibly are higher. If his interest charges are not higher, they would be if he charged against his plant all legitimate accounts. When he builds a new plant, the engineers put in everything before beginning operations. Later he takes many of them out.

The writer has seen plans for a French foundry in which 10 cupolas were specified for melting less than 60 tons of iron per day, and for less than 30 tons of iron per day, he has seen 400 men employed. These plans were prepared by 30 draftsmen working for more than seven months, and are at least the third or fourth set which have been prepared.

Many well designed plants can be obtained at the present time in France without excessive cost. To operate these plants officially, a few changes would be necessary to install American methods for the production of automobile or other castings. To obtain results, the following precautions should be observed:

(1) Prepare definite specifications covering all raw materials and methods entering into the manufacture of the product. If the product has been made successfully in America, prepare the exact specifications which have given the best results. The proper raw materials can be found in France, or on the continent.

(2) A competent American organization should be sent over to see that the specifications and methods are followed. Otherwise, the game of politics will take precedence over everything else, and before one is aware of the fact, something has slipped.

From the foregoing it must not be assumed that French foundries are not successful as this certainly would not be true. The point is that American methods cannot be installed with a French organization, due to the difference in viewpoint and the French tendency to change things which have proved successful in America.

As a proof of this, one only has to speak with members of the French missions which visited American plants during the past year. One is told by 50 per cent of these men that American firms are mere infants on production, forging, heat treating and black heart malleable manufacture, regardless of the fact that not one member of these missions was an expert on any one line and in many cases had no practical experience whatever. The French engineer is not a specialist, and when these missions return to France, many of the members found that due to internal plant politics the information which they had collected was of absolutely no use so far

as the owner of the plant was concerned. Those who studied foundry conditions were side-tracked to a place where no use could be made of the result of the visit to America and equipment purchases were made in Germany.

If it could be made possible to interchange visits with French foundrymen under the direction of the French and American foundry associations, much good would result for all. There is absolutely no doubt that America can learn much from France along many lines of research and development and France can learn much from America on production and supervision. One thing which French foundrymen would learn is that our foundries are not laboratories.

Practice Is Standardized

Out of twenty-six papers presented at a convention of French foundrymen, recently, seven were on the subject of sands for molds and cores. This would seem to indicate that after years of molding practice, France now is working on a problem which must be given attention if it is to carry on intensive production. Many of the papers contained information which has been available to American foundrymen for a long time, such as the use of steel in mixtures and grading iron by analysis. In any American automobile foundry producing from 200 to 2000 cars per day, the sand, core and iron problems already are solved to the extent that regular results are obtained and no great changes will be made in general practice.

That American equipment or methods ever will become popular in a French foundry with a French organization, is problematical. An attempt at these introductions strikes at the root of the problem of life in France. With our methods a great change in the method of producing a certain piece in the foundry would be given considerable thought before the change would be authorized by a manager or board of directors. In France, changes are the paramount object of the engineering profession and in consequence, continual changes are being made. Engineers constantly are added to an already overloaded non-producing staff. Unsatisfactory conditions result in a change of management and the cycle starts again.

French automobile foundries have a scrap account, due to porosity, which would put an American foundry out of business in a few months. They try all sorts of schemes to overcome this such as putting chills in the barrel cores and in the jacket. With such methods, they get scrap in the machine shop after reaming the barrels, even though the cylinder passes the hydraulic test in the foundry and is considered a good piece. They will do everything except reduce the phosphorus content.

Fortunately the ordinary foundry can stand this loss on cylinders. They do not have intensive production on any one pattern and perhaps cast an extensive line of machinery castings in the same foundry, but not with the same iron. The profit on the heavy work to a certain extent makes up for the loss on cylinders.

Machines even in the larger plants are not used to the extent which they are in America. Many plants operate with small hand rammed, hand draw machines, and others have complete hydraulic machine installation. American jolt ram, squeezer machines are being installed, but the American jolt ram machine manufacturer must realize that the prejudice in favor of extremely fine sand is against the successful operation of his machine. In addition to this, he must overcome the national prejudice existing against intensive production. While the machines do all that is claimed for them the French foundrymen gains nothing if compelled to change patterns from six to ten times per day. In few foundries could a machine be operated to maximum capacity on one pattern for any length of time. The largest automobile builder in France makes but 300 cars per day at the peak of his production.

Order German Machines

Another point for the attention of the American manufacturers is that at present there is a strong indication that cordial trade relations shortly will be resumed between France and Germany. A good line of foundry equipment is produced in Germany, and the writer knows that considerable foundry equipment business which was to have been placed in America, was placed in Germany, by a large automobile producer, during October 1924. A French laborer is quite capable of putting up a good day's work on a machine, but unfortunately there is little French labor in the foundries.

French molders are professionals, in that they have served a long apprenticeship, and are capable of turning out work of the highest grade. In addition to making the mold, often without a complete pattern, they will make their own dry and green sand cores. They are thoroughly trained in all branches of their trade, and require little supervision. Unfortunately these men seldom become either foremen or superintendents. These positions are filled by men with a theoretical education gained in all branches of the metal industry, pattern shop, foundry, forge and machine shop. When one of these men becomes director or manager, he surrounds himself with old classmates, or graduates of the same school, as heads of various departments, regardless of what experience the classmate may have had since graduation.

The engineers of France seldom are specialists. They drift from one line of work to another, according as the management may change. A new manager generally means an entirely new organization. This is a natural condition when one considers that the same opportunities do not exist in France as in America, and it is much more difficult to find and hold a position through one's particular ability in a certain line. To live one must play politics with the men who have the giving out of the jobs, and therefore, politics in France are as natural as getting up in the morning.

Recruit Common Labor

Common labor in France at the present and especially in the larger cities is recruited from Arabs and Algerians. The local government of Algeria, which is a colony of France, has an agreement with the French government at Paris, by which the Algerians travel back and forth at favorable rates. These laborers stay in France for eight or nine months and then return to Algeria for three or four months' repose during the cold weather. The French foundry foreman has no use for them and has a constant labor turn over.

The French molder receives 4 or 5 francs per hour. At the old value of the franc (20 cents), this would be equal to the pay of our foundry workers doing the same class of work, 80c to $1.00 per hour. However, for several years, the franc has been worth approximately 5 cents, so that he really receives about 25 cents per hour. This depreciated value of the franc does not apply to the selling price of the article which the workmen turns out, as practically all selling prices in Paris and most parts of France, are based on the dollar value. Many visiting Americans have found this during the past year.

American foundrymen are acquainted with what is sold in the United States as French sand. Without going into any discussion of the analysis, the general knowledge or impression is covered by the expression fine sand. There may be a great difference in the chemical analysis of French sand and American fine sand, but usually the terms French sand and fine sand are synonymous.

Nearly all French sand is extremely fine, and in many cases contains a clay and other impurity content ranging from 34 to 54 per cent. As a general rule, this sand is shipped to the foundries in open cars, and arrives in a wet condition. The clay and silica are not blended as in American sands, but run in streaks and lumps. When this sand is unloaded from the cars and left exposed to the sun or heat, the lumps of clay become as hard as bricks. On ac-

count of this uneven condition and the existence of lumps, the majority of foundries put all new sand through drying stoves, after which it is run through a mill. The result of these two operations is a sand which appears and feels about the same as well milled flour.

Any attempt to add this sand to a sand heap without drying and milling, courts disaster. These small, hard balls of clay refuse to absorb moisture and break up. When passed through the riddle, the clay balls naturally would be thrown out and nothing would be added to the heap but fine silica. The intention is not to give the impression that all French sands have these characteristics, or that a coarse, open sand cannot be found in France. Such is not the case. For years French foundries have been drying all molds, and a strong prejudice exists among workmen and managers against the use of an open sand for green sand molds.

The average French sand of any grade has a short life and it is practically impossible to make a mold with the heap sand. For a certain class of castings in the United States, it might be possible to turn out from 4 to 8 tons of castings with 1 ton of new sand. The same class of work in France would require from ½ ton to 1 ton of sand for each ton of castings. All molds are made with an exceptionally large quantity of prepared facing sand in all foundries which the writer has seen. This facing contains anywhere from 25 to 60 per cent new sand, and even then the sand heaps are what we would term *rotten*. Our American practice in many lines of work, is to use no facing whatever, but to use the heap sand for the complete mold. From this it will be seen that the 34 to 50 per cent *fines* really contain little natural bonding qualities, such as we are accustomed to in America.

Core Sand Varies

The core sand found in France is not uniform. Many silica deposits are available but it seems to be a difficult undertaking to get a constant quality. The general run of sand is fine, but cannot be compared with our Michigan City sand, for core purposes. A strong prejudice exists in favor of fine sand generally mixed with molasses or glucose. The mixture is as stiff as ordinary putty, and practically is pushed into the boxes. Linseed oil has not attained a general use, and is looked upon as an expensive binder. The molasses and glucose mixtures naturally are in favor among the core makers. Few cores are lost in the core room, and little skill is required.

The writer used a fairly open silica sand bonded with linseed oil for jacket and barrel cores. During his last few weeks, while occupying the position of silent observer, these mixtures were all changed to fine, split grain quartz bonded with glucose. This change was made on the recommendation of the supposed highest foundry consultant in France, on the theory that a linseed oil core gives off gas, which we all admit, and that a glucose mixture absorbs all gases, which is questionable. The result of this change raised the scrap in the machine shop over 100 per cent above that from the previous practice, and all sorts of factors were blamed for this increase, except cores. An examination of the interior of the jacket would have shown beyond a doubt, where the trouble originated.

These cores had a wonderfully smooth, hard finish, but an examination of the castings showed an interior which looked as if it might have been done with a hammer and chisel. Foundry losses due to cores are about equal to those due to porosity, especially in the foundries experimenting with green sand molds. Practically all French cylinders still are made in dry sand molds. Only one foundry of any size makes them in green sand and one other will start within a short time.

One progressive foundryman of France has developed a core binder for ordinary use which hardens in the air, no baking being required. The cores made with this binder seem to be of excellent quality, and ordinary small cores can be used from one-half to one hour after making. The cores do not blow and have a good surface.

Pig Iron in Small Lots

The pig iron in every respect is equal to an American product for quality and uniformity of analysis. Most of the furnaces make an exceptionally long, sand cast pig from 30 to 40 inches in length which has to be broken into two or three pieces before charging.

Practically any analysis of pig may be obtained, but naturally, on account of the smaller capacity of the furnaces, greater attention must be paid to purchases, to insure an even product in the foundry. A furnace may run a foundry iron of a certain analysis for several days in the year. The tonnage will run from 400 to 1200 tons. Few foundries are able to contract for any such amount, so the 400 to 1200 tons are sold in 10 to 50-ton lots. When the smaller buyer tries to obtain more iron of the same quality, he finds the run exhausted. This accounts for many French foundry troubles, but the firm which can contract for reasonably large amounts, will experience no trouble in locating a supply.

Many automobile foundries import from England a high phosphorous iron for making cylinders. This is due to their cylinder specifications which call for a phosphorous content of 0.70-1.00 per cent. The theory is that this even shows a higher Brinnell test, and has a higher fluidity. The analysis of this English iron is practically the same as machinery scrap, and in practice it was found that the scrap gave better results. Reducing the phosphorus to American standard and lowering the silicon a little below that which we generally have, the Brinnell result was not changed and the microstructure of the iron was far superior to that found in general French practice. The fluidity showed no change whatever with good cupola practice.

An investigation of manufacturing conditions and market possibilities of several staple foundry products, pipe fittings, soil pipes and several other specialties, made of either cast iron or malleable iron would seem to indicate that there is a tremendous field in Europe for the manufacture and sale of those staples. In the pipe fitting line, American made screw and flange fittings are coming into general use.

Pipe fittings are not standardized in Europe and it is still general practice in France as well as most of southern Europe to weld pipes with a torch.

Make Cupola Malleable

The only black heart malleable iron made in France is turned out principally by two American firms who are using their entire output in their machines and specialties. The French make malleable iron castings, by the cupola process but the castings are far below those turned out by the American cupola malleable iron manufacturers.

Air furnace malleable iron is unknown or if some of it is exploited the product obtained is not comparable to American made furnace malleable. As an illustration, French firms are accepting castings with a 3 to 5 per cent elongation, and a bending coefficient not greater than 5 to 10 degrees, before breaking. This test being made on a ⅞-inch square bar.

When it is remembered that France has four or five large automobile plants with a reasonably large output, and when it is also considered that several staple products could be turned out of black heart malleable iron, it seems reasonable to infer that a malleable iron foundry iron run along American lines would be a profitable venture.

A good deal of pig iron used for French malleable is imported from England, but good mixtures can be made with French pig iron. Naturally the advisability of importing from England depends largely upon the location of the plant. Good furnace bricks and the proper coal can be had without any difficulty.

Reducing Costs

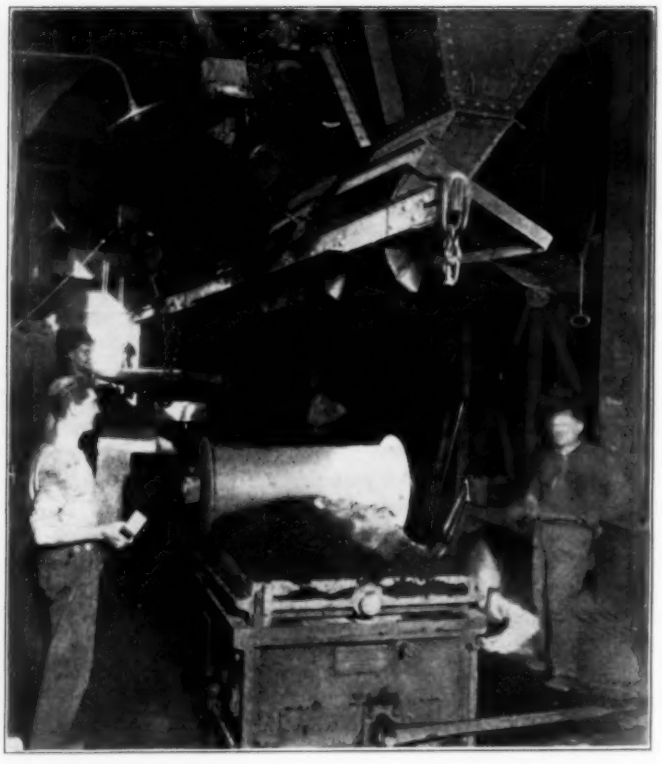


Fig. 1—After the Sand Is Dropped from the Overhead Bunker, the Roller Rammer Is Passed Over the Mold as Indicated

WHILE conforming in many respects to what may be regarded as standard practice in American soil pipe foundries, several innovations recently introduced at the plant of the National Foundry Co., Brooklyn, N. Y., place it in a classification by itself. It is claimed that production has been increased 35 per cent without any increase in the number of employes and with a gratifying decrease in the amount of manual labor apportioned as each man's share under the new dispensation. Ease and speed of operation due to the adoption of mechanical equipment has standardized methods to an extent that insures a better and more uniform product and this in turn has been reflected in the reported costs which are sufficiently below costs under a former method to justify the wisdom of making the change.

The three principal items responsible for present conditions include a flask in which eight castings are molded at one time, a sand preparation plant which handles all the sand at one point and feeds it to the flasks from a storage hopper as required, and an extensive improved type of monorail with branches extending to every department and equipped with suitable electrically operated hoists. Details in connection with these various pieces of mechanical equipment are shown in the accompanying illustrations.

Since practically all the items in the sequence of operating involve the use of the monorail system it is only logical that it should receive first consideration in any attempt to describe the manner in which soil pipe castings are produced in this foundry.

The system was designed and installed by the Cleveland Crane & Engineering Co., Wickliffe, O., to meet the particular requirements of the plant as outlined by Max G. Niman, president of the National Foundry Co., who also supervised the installation to an extent that practically offered no interference with operation of the foundry while the change was being effected. Approximately 1200 feet of monorail track are provided. The track is arranged in parallel lines over the molding floors to accommodate two transfer bridges, but consists of a single line at all other points including that over the molding machines and the loop located directly in front of the cupola.

Each half of the finished mold weighs approximately 2 tons constituting a rather heavy load for a single rail suspended from the beams over the molding floors. To distribute the load equitably and also provide a means of pouring both ends of the flask at the same time from two ladles, a special bridge was designed to be suspended from two parallel rails. By referring to the illustrations it may be noted that the 2-ton hoist made by the Shepard Crane & Hoist Co., Montour Falls, N. Y., is suspended from 16 trolley wheels attached to the hoist frame in groups of four. The wheels are supported on the lower flange of an I-beam that constitutes the bridge of a crane suspended from suitable rollers on two parallel rails.

With this arrangement it is apparent that the load may be shifted from the double to the single carrier by bringing the I-beam bridge of the upper crane into line with the single track which extends above the molding machine or the other single track which serves the shakeout device locally known as a grizzly. The single tracks are set at right angles to the tracks that are arranged in parallel pairs above the floors where the molds are assembled and poured. Automatic stops on the carrier prevent the trolley wheels from rolling past either end while the hoist is suspended from the two parallel rails.

In effect the double monorail serves as a crane runway in assembling the

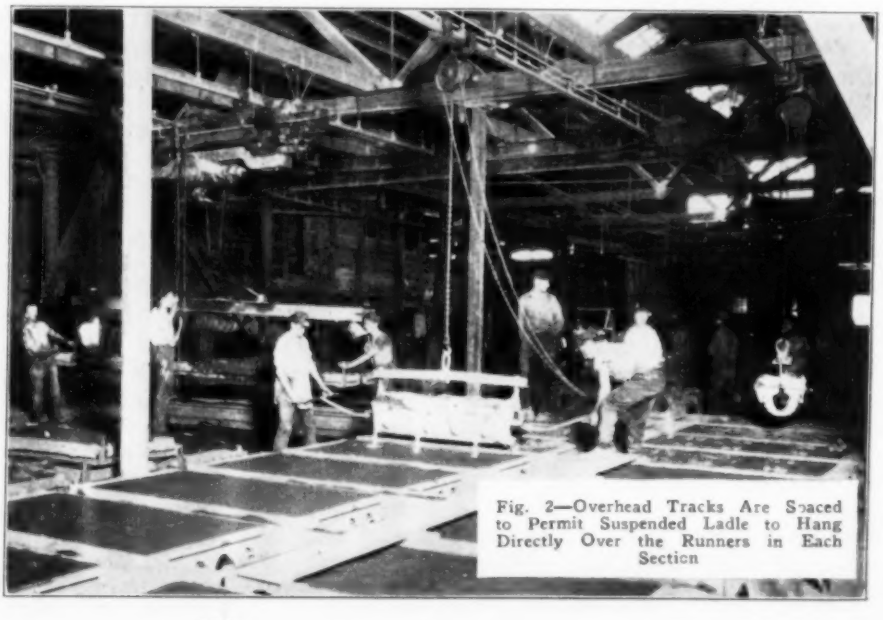


Fig. 2—Overhead Tracks Are Spaced to Permit Suspended Ladle to Hang Directly Over the Runners in Each Section

On Soil Pipe

By R. E. Nelles

molds while each track is used individually to convey a ladle of iron suspended from a small chain hoist, while pouring off the floor. The rails are spaced at the proper distance apart to bring a triple-lip ladle suspended from each rail directly over the runners in the cope in each half of the long flask. This feature is illustrated in Fig. 2 where it may be noted that the iron does not flow over the lips, but through three openings close to the top edge at one side of the nearly rectangular ladle. In this manner the iron automatically is skimmed before it enters the runners, and incidentally the method eliminates the services of one man with a skimmer to each ladle.

Obviously this 1000-pound ladle handled by two men and capable of pouring several flasks on each trip from the cupola is a distinct improvement over the method formerly in vogue where the molds were poured either three or four-up, by a number of men equipped with hand ladles. A separate trip to the cupola was involved for every pair of castings which were made at that time two in a flask. Hand ladles still are employed in this foundry to some extent, but they are filled from a bull ladle suspended from a chain hoist and are used singly to pour the miscellaneous line of fittings used in connection with soil pipe installations.

The most radical departure from the orthodox method of molding soil pipe castings is shown in the type of flask employed in which eight castings are made at one time as contrasted with the ordinary type of flask in which only two castings are made side by side. The method of gating is similar to that employed on the smaller units where three or in some cases, four, upright runners are set in a row between each pair of patterns to which they are connected through one single, long, horizontal gate and a number of small, flat gates that conduct the iron rapidly to all points in the mold. The casting is made to a standard length of 5 feet 6 inches, with an average metal thickness of ¼-inch and only can be poured successfully with hot iron poured quickly through a set of gates that will insure rapid and even distribution over the breadth of the mold.

Fig. 4—A Double Set of Eight Patterns Is Mounted on a Stripping Plate Machine Served From a 90-Ton Hopper

Equipment for making the molds is shown in Fig. 4. The pattern equipment and roller rammer device were supplied by Ritchie, Brown & Donald, Maspeth, L. I. The patterns are adjusted in a stripping plate so that they may be lowered out of the way before the rammed flask is lifted from the plate. The stripping plate is mounted on a rectangular cast iron box, and if nessary may be changed for a plate with patterns of a different size. The plate is provided with guide blocks at two diagonally opposite corners which engage corresponding depressions in the corners of the flask. These serve to locate the cope on the plate and afterward locate it on the drag. The pattern plate presents gaps in the two remaining corners to accommodate rectangular guide pins attached permanently to the corners of the drag.

From the foregoing it is apparent that the patterns must be fitted in an extremely accurate manner on the plate so that the cope and drag, made on the same plate, will coincide when the drag is rolled over and the cope lowered into place on top of it.

Each half of the cast iron flask 36 inches wide and 15 feet in length is made in one piece and is reinforced in the center with two end pieces 15 inches apart and provided with openings to accommodate the ends of the cores. The 15-inch space in the center serves to divide the flask into two units with four pipes in each. Steel bars with four gaps cut in them to correspond to the shape of the four pipes are attached to suitable sockets on the inside of both sides

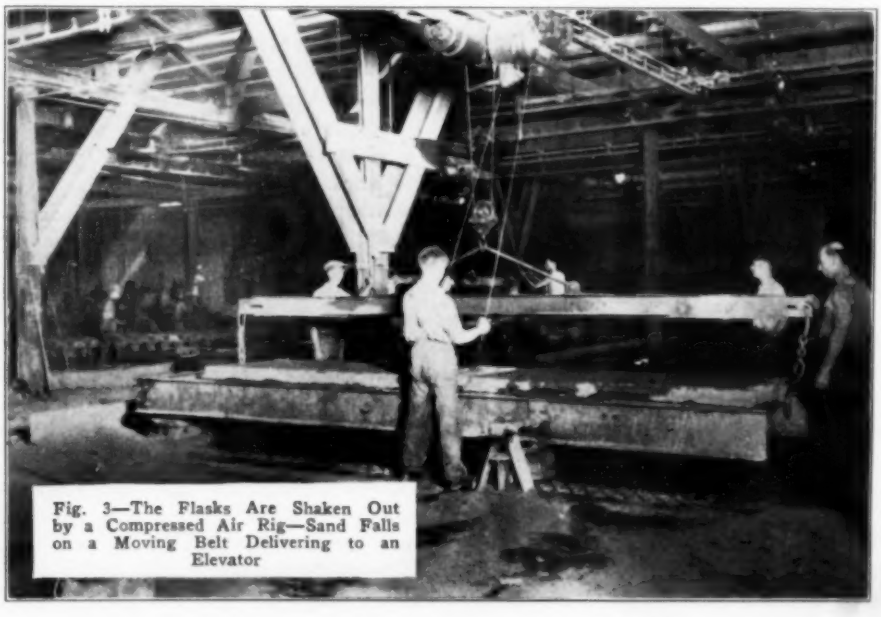


Fig. 3—The Flasks Are Shaken Out by a Compressed Air Rig—Sand Falls on a Moving Belt Delivering to an Elevator

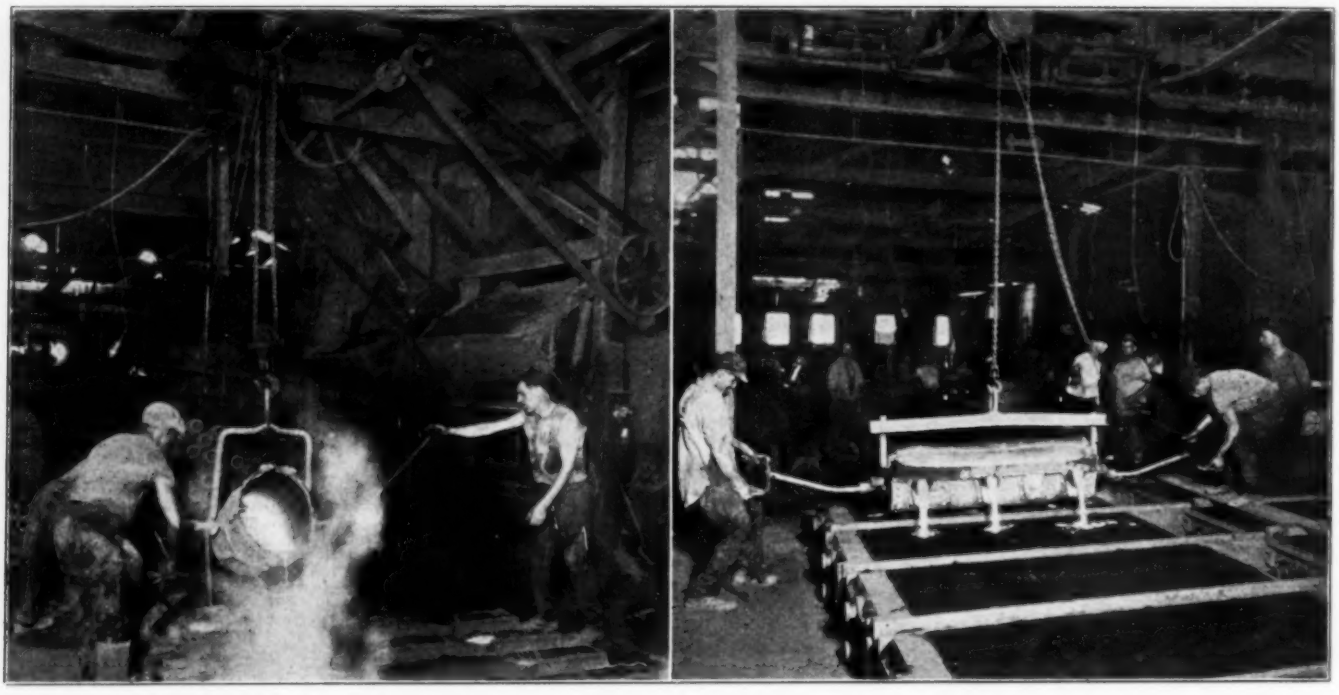


FIG. 5—CORES ARE SWEPT ON CAST IRON BARRELS AS SHOWN AT THE RIGHT—SAND FALLS WITH SUFFICIENT FORCE TO ADHERE TO THE BARREL. FIG. 6—IRON IS POURED FROM A SUSPENDED LADLE PROVIDED WITH TRIPLE LIPS

of the cope and drag flasks. If necessary, the bars may be removed and replaced by others with the gaps cut to a different radius to fit over pipes of a different diameter. With this type of drag flask no bottom plate is required.

The flasks are filled with sand from a 90-ton steel hopper through a pair of twin chutes as shown in Fig. 4. Each chute is controlled individually by a gate which regulates the amount of sand falling into the flask. The flask first is filled about half way and rammed by hand in straight lines between the patterns. Then it is filled heaping full and rammed by passing a heavy roller forward and back over it.

Sand Handling Equipment

After the castings are poured, the flasks are lifted one half at a time and taken to the shakeout station where the sand is treated with water and then dumped through a grating. The shakeout device is made up of an I-beam frame hinged at one end and attached at a point near the other end to an air operated piston which alternately lifts the frame and allows it to fall. The flask which rests on the frame is jolted to an extent that soon knocks all the sand out of it. Empty flasks are piled at a point where they readily may be returned to the molding machine.

The sand drops on to a horizontal belt which feeds a bucket elevator which in turn discharges the sand into the storage hopper referred to previously. Within certain limits the bin serves as a balance wheel to the entire system in that it insures continuous operation even should there be a halt or a breakdown in the shakeout apparatus or in the belt or elevator leading to the hopper. A little new sand is scattered daily over the drags after the castings have been removed and before the sand is shaken out of the flasks. The process of passing the sand through the grating, over the belt, up the elevator and into the storage hopper renders it fit for use without further manipulation.

Castings of all kinds, straight lengths and special shapes are loaded on carriers suspended from the monorail and taken to the cleaning room where they are cleaned in a series of tumbling barrels, then dipped in a tar bath in the usual manner and shipped. Green sand cores for the straight pipes are swept on cast iron barrels under the sand hoppers shown to the right in Fig. 5.

Sand Sticks to Pattern

Question: We have in use a considerable number of aluminum patterns and experience a great deal of trouble trying to keep them clean. The sand appears to stick to the surface. Will you kindly tell us how to prevent this?

Answer: The condition may be due to one, or a combination of many causes. The clay content of the sand may be too high. The sand may be too wet. You may be using hot sand on a cold pattern or *vice versa*. It is impossible to propose a specific remedy from the meagre data supplied; but by enumerating all the probable causes of the trouble you will have an opportunity of comparing the symptoms with those in your particular case.

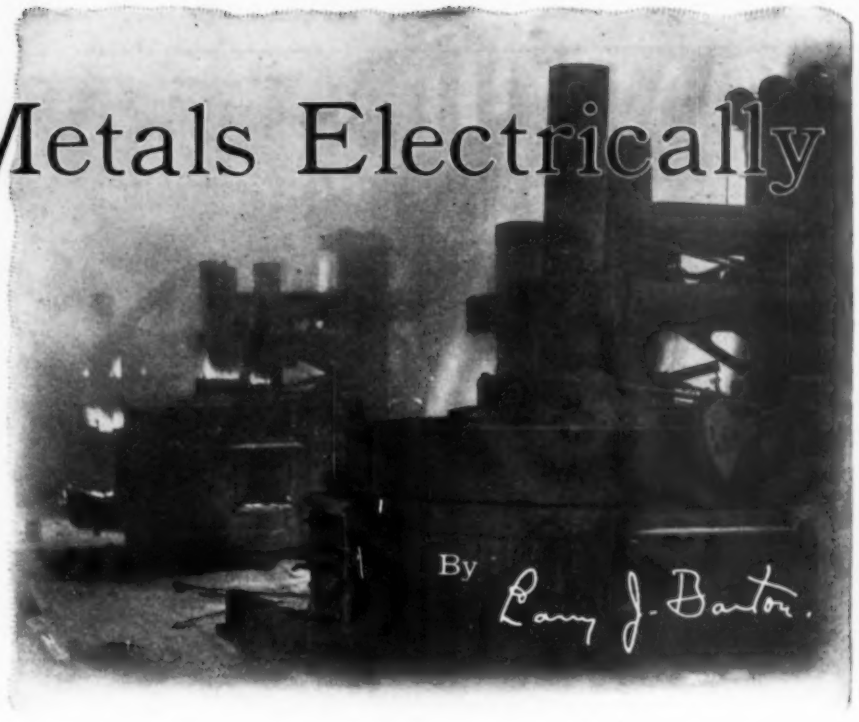
Sand that carries too much clay so that it must be rammed softly and vented excessively is a constant source of trouble in a foundry. In addition to sticking to the patterns it is a fruitful source of scabbed and distorted castings. False economy based on the fact that the sand is a local product sometimes blinds a foundryman to the ultimate loss sustained through the extra time and care required in its manipulation.

Sand employed for green molds should be worked as dry as is consistent with its ability to hold its shape and for that reason the sand should be as coarse and open grained as is compatible with the size and weight of the casting. Fine clayey sand will stick to a pattern where a more open grade of sand carrying an equal moisture content will strip clean.

Moisture condensed from hot sand on a cold pattern will cause the sand to stick. Sometimes, especially in cold weather, patterns are heated artificially and this condition also causes the sand to stick if the pattern is raised to a noticeable heat or if the sand contains an undue amount of clay. Under certain circumstances the patterns are sprayed with gasoline and usually they are sprinkled with parting powder, but the main point is to work the sand dry and open.

Oscar W. Loew has been placed in charge of advertising and sales promotion work for the Truscon Steel Co., Youngstown, O.

Refining Metals Electrically



Chapter IV (Continued)

How Manganese Steel Differs in Its Melting Phenomena —Using Return Scrap

TO THIS point the description of the manufacture of manganese steel has paralleled that of plain carbon heat. From here this metal differs in its treatment. In ordinary steel heats, a carbide slag is formed at this time, and the metal is de-oxidized by its strong reducing action. However, with manganese still due to the large percentage of manganese contained, it is difficult to obtain a carbide slag, although in certain instances the slag will powder on exposure to the air. While the content of manganese and iron oxides in the final slags from carbon steel are extremely low, in making manganese steel it is unusual for these constituents to be much under 2 to 4 per cent for manganese, and 7 to 10 per cent for the iron. Naturally, if the melter waits for the slag to turn into the carbide condition he is likely never to finish the heat. Often, heats of excellent steel may be poured under slags of a distinct green color, and containing as high as 5 to 7 per cent metallic manganese.

The following shows the analysis of a slag which partly powdered on exposure to the air:

	1 P. M. Dark Brown	2 P. M. Brown	2:10 P. M. Light Brown	2:45 P. M. White Powder
Silica, per cent	28.02	34.70	33.50	33.60
Iron oxide and Aluminum oxide	20.70	16.00	10.00	9.40
Lime and Magnesia	48.38	49.49	56.45	58.42
Manganese oxide	7.02	4.45	3.75	1.59

Some slag losses on other heats are as follows, the slags being green of various shades, ranging from a light pea green to a dark sea blue in color:

Manganese in Steel Per cent	Manganese in Slag Per cent
10.53	6.47
11.11	6.67
11.92	2.79
11.65	1.23
11.26	3.91

Slags continuing from 8 to 20 per cent manganese usually will be green or blue in color; those from 6 to 8 per cent, dark brown; 4 to 6 per cent, light brown; and 2 to 4 per cent, a light brown or whitish gray. Of course, exceptions to this rule will be observed but these occurances have been found on several hundred heats.

As the slag offers little aid in judging the quality of the metal, recourse must be had to another method, that of using the metal itself as the indicator, regardless of the condition of the slag. Only one point will be mentioned in regard to slag manipulation. That is, the slag should be kept as thick and limey as possible during this finishing to conserve as much manganese as possible. A slag tending toward the acid state always holds a much greater percentage of manganese in combination than a slag of strong basic character. Furthermore, reducing conditions proceed better, and the metal heats faster under the thick lime slag, than under one tending toward the glassy state.

In making carbon steel this feature can be handled by taking a test, breaking it, and noting the solidity. If gassy, or wild, the metal is unfinished. If thoroughly solid, the heat can be poured. With the high percentages of manganese in manganese steel such a procedure is out of the question, for with such a quantity of this oxygen destroying element present it would be impossible for the metal to contain blow holes. However, if a test taken here shows solid this is absolutely no indication that the metal is finished, or in any condition to pour. This manganese was added to a steel which was heavily impregnated with oxides. Naturally, the first reaction will be that the manganese will combine with all the free oxides present, and cleanse the steel from these impurities. An additional amount of oxides is present at this time, actually dissolved in the metal, which will not react at first with the manganese. As soon as all the free oxides are removed, the steel will show solid, but if it were poured containing this amount of dissolved oxides, the result would be a heat giving a large proportion of cracked castings, due to the influence of these impurities during the period of solidification.

Therefore, the point of importance is how to tell when these oxides have been removed from the metal. As the steel heats up it becomes more fluid, and is naturally under heavy reducing conditions. These points allow the manganese gradually to absorb all of this dissolved oxide, and free the metal. This generally occurs by the following steps:

1. Heat of carbon steel containing a large proportion of oxides.

Tricks Explained

MELTING manganese steel in the electric furnace involves many little details of practice that make it difficult for the melter of ordinary carbon steel to learn the tricks. In this installment of his series, Mr. Barton explains briefly and lucidly how to handle the manganese bearing steels. He shows clearly how slags cannot be relied upon to indicate the state of the melt. Rapid, visual tests, which are supplemented immediately before pouring by an analysis furnish a sure means for judging quality of metal. The ratio of manganese to carbon is a measure of desirable properties. Chemical reactions are explained. In the concluding portion of the chapter on manganese steel, the author will give the method of slag manipulation and outline the metallurgical characteristics of this most unusual metal.

TABLE XXXVIII

Logs of Manganese Steel Heats

The charge consisted of the following constituents:

	Pounds
Heads and gates (carbon steel)..	800
Punchings, low carbon	3,000
Turnings	650
Ferromanganese (later)	780
Total	5,230

The analysis of the steel was as follows:

	Per cent
Manganese	11.62
Carbon	1.26
Silicon	.45
Phosphorus	.055
Sulphur	.011

Total time for heat 4 hours 55 minutes. Kilowatt hour current consumption 3500 or 1335 per ton.

Time

10:20 Power on. Low amperage. Voltage 104 to 106.
10:35 Power off to lower electrodes.
10:45 Power on. Amperage 4500.
11.10 3 shovels burned lime, 60 pounds.
1:20 Amperage reduced to 3500; 60 pounds lime added.
1:40 All melted
2:05 First metal test taken, carbon 0.12 per cent. Slag a dark brown.
2:15 25 pounds of ground electrodes added.
2:18 Changed to low voltage, 83.
2:25 Slag white.
2:30 High voltage, 106.
2:32 100 pounds ferromanganese on hearth at each door.
2:40 First 100 pounds in No. 1 door; second 100 pounds heating.
2:44 First 100 pounds in No. 2 door; second 100 pounds heating.
2.48 to
3:08 Manganese added 100 pounds at a time from alternate doors.
3:15 Tapped adding 0.25 per cent silicon to ladle.

The weight of metal was 5100 pounds and the weight of the slag was 310 pounds.

The manganese added on this heat figured to 12.00 per cent of the total charge, disregarding that contained in the charge (approximately 0.50 per cent).

The bend test broke at 135 degrees.

SECOND HEAT

The charge was constituted as follows:

	Pounds
Heads and gates (carbon steel)..	500
Punchings	4,100
Turnings	500
Ferro manganese (later)	890
Total	5,990

The analysis of the steel was as follows:

	Per cent
Manganese	11.02
Carbon	1.33
Silicon	.56
Phosphorus	.046
Sulphur	.013

Time of melting 6 hours. Kilowatt hours used 3900 or 1300 per ton.

Time

9:30 Power on. 3000 amperes. Voltage, 100 to 102.
9:45 75 pounds lime added; 4500 amperes.
11:15 15 pounds lime.
1:00 60 pounds lime.
1:30 First metal test for carbon, 0.30 to 0.35 on fracture; slag black, to brown in spots.
1:40 Hole in roof.
1:50 60-pound mill scale; 2500 amperes.
2:05 Carbon 0.45 per cent by analysis.
2:10 45-pound mill scale.
2:15 Carbon 0.30 per cent.
2:20 30-pound mill scale.
2:30 Slagged off.
3:35 100 pounds lime.

Up to

3:10 Manganese added.
3:20 10-pound ground electrodes.
3:30 Heat tapped, adding 0.40 per cent silicon to ladle.

The weight of the metal was 5655 pounds and the weight of the slag was 350 pounds while the slag was deep green at the pour.

Bend test broke at less than 90 degrees.

The two logs here given were made from two heats melted under poor conditions in a new shop where the practice had not been thoroughly developed. Consequently they can be classed only as mediocre heats.

To show what a difference practice makes, the logs shown in Table XXXIX are given from heats made one year later.

2. Manganese of approximately 13 per cent added.
3. All free oxides combine with the manganese as MnO, and pass into the slag.
4. Heavy reducing conditions in slag break up this oxide allowing the manganese to be freed and pass back into the metal.
5. Metal solid at this point. Slag green.
6. Metal heating and slag reducing.
7. As soon as slag begins to get low in manganese, this element becomes active in the metal and gradually exerts a sufficient influence on the dissolved oxides to free them from their combination with the iron.
8. These dissolved oxides gradually are freed from the metal leaving it in a finished condition.

To follow these actions, a special test piece is poured at intervals during the finishing. This is a piece approximately 12 inches long, and ½ by ¾ inches, poured on end in a sand mold, made by pasting two cores together. As soon as solid, this bar is water quenched, and bent until broken. The mold and breaking block are shown in Fig. 35.

The first test taken after all of the manganese is added probably will bend only 90 degrees before breaking, the fracture having more or less of a granular appearance, and in the majority of instances will show colored steaks, indicating an oxidized state. However, as reduction proceeds, this test will begin to show a larger degree of bend, and the fraction will assume a silky appearance, being a silvery white, and absolutely free from any trace of color. When this point is reached the metal is satisfactory and may be poured.

Manganese steel as often described, consists of an iron alloyed with manganese, carbon, silicon, phosphorus and sulphur. The amount of this last name element of course is negligible, for its removal is almost absolute in the presence of such a large amount of manganese. The manganese sulphide formed rises to the surface where it burns off rapidly as sulphur dioxide.

The amounts of manganese mentioned vary from 10 to 13 per cent, and as might well be imagined, this wide variation offers distinct changes in its properties. Also, it often has been stated that a manganese steel must be as low in carbon as possible, that its ductility may remain high. Figures given have stated that the ratio number should remain as high above 10.00 as can be had, this figure being obtained by dividing the percentage of manganese in the steel by that of the carbon.

The following figures illustrate this point:

Series 1 Percentage		Series 2 Percentage		Series 3 Percentage	
C	Mn	C	Mn	C	Mn
1.01	11.26	1.07	11.75	1.22	12.01
1.00	11.06	1.11	11.92	1.18	12.30
.95	10.86	1.00	11.39	1.15	12.42
.90	10.53	1.05	11.54	1.17	12.84
.93	11.11	.97	11.92	1.16	12.62
.99	10.82	1.04	11.44	1.32	13.07
		1.12	11.63	1.35	13.93
				1.24	12.77

The averages are:
Series No. 1: Carbon, 0.96 per cent; manganese, 10.94 per cent; giving a ratio of 11.40.
Series No. 2: Carbon, 1.05 per cent, manganese, 11.61 per cent; giving a ratio of 11.00.
Series No. 3: Carbon, 1.22 per cent, manganese, 12.74 per cent; giving a ratio of 10.40.

All of these three groups fall within the allowable analysis. All have a higher ratio than 10.00, yet there are great differences in their physical properties.

All of the steels in series No. 3, bent cold on the standard test bar bend 180 degrees without any appearance of a

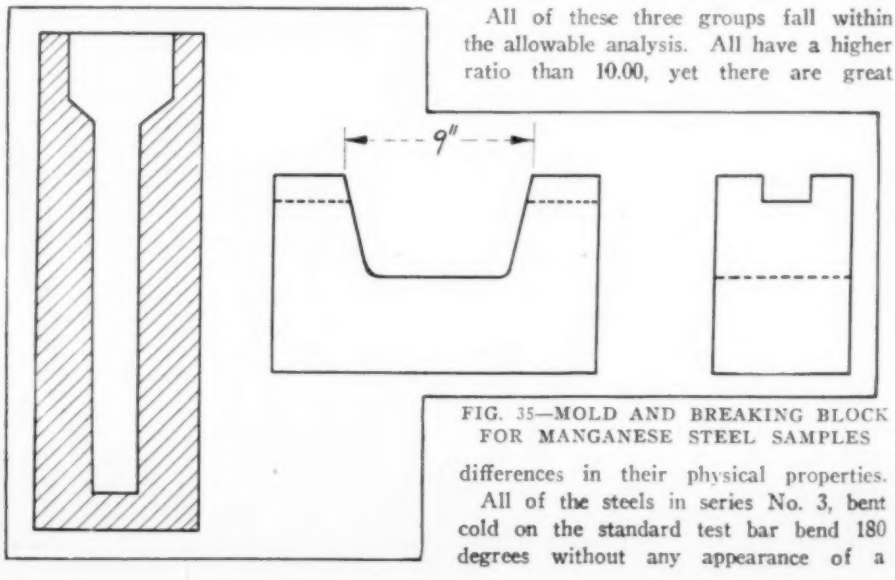


FIG. 35—MOLD AND BREAKING BLOCK FOR MANGANESE STEEL SAMPLES

FORMULAS FOR CONVERTING METRIC MEASURES

MEASURES OF LENGTH

Inches = Millimeters x 0.03937
Inches = Millimeters ÷ 25.4
Inches = Centimeters x 0.3937
Inches = Centimeters ÷ 2.54
Inches = Meters x 39.37
Feet = Meters x 3.281
Feet = Kilometers x 3280.8
Yards = Meters x 1.094
Miles = Kilometers x 0.6214
Miles = Kilometers ÷ 1.6093

MEASURES OF SURFACE

Square inches = Square millimeters x 0.001550
Square inches = Square millimeters ÷ 645.2
Square inches = Square centimeters x 0.155
Square inches = Square centimeters ÷ 6.452
Square feet = Square meters x 10.764
Acres = Square kilometers x 247.1
Acres = Hectare x 2.471

MEASURES OF VOLUME

Cubic inches = Cubic centimeters ÷ 16.387
Cubic inches = Liters x 61.022 (Act of Congress)
Cubic feet = Cubic meters x 35.315
Cubic feet = Liters ÷ 28.316
Cubic feet = Hectoliters x 3.531
Cubic yards = Cubic meters x 1.308
Cubic yards = Hectoliters x 0.1308
Fluid drahms (U. S. P.) = Cubic centimeters ÷ 3.697
Fluid ounces (U. S. P.) = Cubic centimeters ÷ 29.57
Fluid ounces (U. S. P.) = Liters x 33.81

FORMULAS FOR CONVERTING METRIC MEASURES

U. S. gallon (231 cubic inches) = Cubic meters x 264.2
U. S. gallon (231 cubic inches) = Liters x 2642
U. S. gallon (231 cubic inches) = Liters ÷ 3.785
U. S. gallon (231 cubic inches) = Hectoliters x 26.42
Bushels (2150.42 cubic inches) = Hectoliters x 2.838

MEASURES OF WEIGHT

Grains = Grams x 15.432
Dynes = Grams x 980.7
Fluid ounces = Grams (water) ÷ 29.57
Ounces avoirdupois = Grams ÷ 28.35
Pounds = Kilograms x 2.2046
Tons (2000 pounds) = Kilograms ÷ 907.19
Tons (2000) pounds) = Metric ton (1000Kilos) x 1.102

MISCELLANEOUS

Pounds per square inch = Kilograms per square centimeter x 14.223
Pounds per foot = Kilograms per meter x 0.672
Horsepower = Kilowatts x 1.34
Pounds per cubic inch = Grams per cubic centimeter ÷ 27.68
Pounds per cubic foot = Kilos per cubic meter x 0.06243
Foot-pounds = Joule x 0.7375
Foot-pounds = Kilogram-meters x 7.233
Foot-pounds per second = Watts x 0.7375
B. T. U. = Calorie x 3.068
B. T. U. = Calorie (large) x 3.971
Horsepower = Cheval vepeur x 0.9863
Gravity = 980.665 Centimeters per second
Gravity = 981.2 at London, at 45 degrees latitude and sea level

THE FOUNDRY DATA SHEET, FEB. 1, 1925
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

Around the World with The Foundry

Little Journeys to the homes of our readers

Argentina!

MILES and miles of waving wheat turning to shining gold under the amorous influence of the southern sun and untold thousands of cattle dreamily browsing on the long, lush grass of the Pampas represent wealth in excess of the mythical silver mines which caused the Spaniards to give the country its name.

Bounded on the west by the towering, snow-capped peaks of the Andes; on the east by the Atlantic ocean and extending from the 27th to the 57th parallel of latitude—Argentina, the Land of Silver—occupies one-seventh of the total area of the South American continent.

In this land of immense but undeveloped natural resources manufacturing is carried on to a certain extent; but large quantities of castings and iron, steel and brass products are still imported.

At least 38 foundries are known to be in operation in the country and notwithstanding the handicap of distance and the difference in language and nationality, 6 of the chief executives of representative plants like Cia. Argentina de Hierros y Aceros; Companie Industrial de Electricidad; Sociedad Anon Talleres Metalurgicos—subscribe for The Foundry, the world's acknowledged authority on all phases of the casting industry.

"Wherever metals are cast you'll find THE FOUNDRY"

TABLE XXXIX

Logs of Manganese Steel Heats

The first charge was made up as follows:

	Pounds
Boiler plate scrap	3,000
Clean turnings	3,000
Ferromanganese (later)	1,150
Total	7,150

The analysis of the steel was as follows:

	Per cent
Manganese	12.69
Carbon	1.15
Silicon	.33
Phosphorus	.066
Sulphur	.008

Time for heat, 4 hours 15 minutes, Kilowatt hours current consumption was 3000 or 840 per ton.

8:00 Current on at 120 volts and 4500 amperes.
After a light pool was formed 100 pounds of burned lime was added to form a melting down slag.
10:00 All melted. Test taken shows a dead melt. Carbon later analyzed 0.06 per cent. Raked walls clean.
10:15 Bath given a good dusting of ground coke, and second slag added. This slag was made of 200 pounds burned lime, 75 pounds fluorspar, and 25 pounds, powdered coke, thoroughly mixed before adding.
10:30 Slag well rabbled, and given another heavy coke dusting.
10:40 Slag brown, and porous. Reduction proceeding rapidly.
10:50 40 pounds gravel spar added, and more coke. Metal heating up.
11:00 Metal hot. Slag beginning to powder in air. Metal test shows approximately 0.12 per cent carbon; fairly sound. 20 pounds of ferrosilicon added.
Manganese placed on door sills. 100 pounds added every 2 minutes from alternate doors.
11:30 Manganese all in furnace. Metal medium. Slag green. Added 50 pounds lime, and gave a good dusting of coke. Metal test taken, quenched, and bent shows about 90 degrees before failure, with touches of color on fracture. Structure crystalline.
11:50 Slag white, and slightly powdering in places. No carbide conditions. Metal test bent 120 degrees, but still shows color. Structure tending to silky.
Added 25 pounds lime, and another dusting of coke. Sealed furnace as tightly as possible, and threw current on to its highest possible load.
12:00 Slag whitish green in spots; powdering in others. Fairly thick and working slightly under the electrodes.
Metal test bent over 150 degrees. Fracture absolutely clear of any color, and showing a silvery white. Silky. Added ferrosilicon figured to 0.25 per cent.
12:10 Metal perfect. Slag powdering with a greenish yellow color.
12:15 Poured.

The final bend tests on this heat went flat on themselves without fracture.

SECOND HEAT

The charge included 7000 pounds of plate scrap and 1350 pounds of ferromanganese giving a total of 8350 pounds.

The analysis of the steel was as follows:

	Per cent
Manganese	12.72
Carbon	1.20
Silicon	.41
Phosphorus	.072
Sulphur	.010

Time of heat 4 hours 30 minutes. Kilowatt hour current consumption was 3500 or 839 per ton.

12:00 Current on at maximum load.
As soon as pool formed added 75 pounds lime.
2:10 Metal melted. Metal test about 0.10 per cent carbon.
2:30 Finishing slag added: 250 pounds lime, 75 pounds fluorspar, and 35 pounds ground coke.
2:45 Slag well rabbled and given heavy dusting of coke. Slag brown in spots. Furnace well sealed.
3:00 Slag light brown. Added 25 pound spar.
3:15 Slag white and powdering. Metal fairly hot.
Manganese weighed out and added 100 pounds at a time.
3:45 Manganese all in. Slag greenish blue.
Gave heavy dusting of coke, and 40 pounds lime.
4:00 Slag a light greenish white. Metal bends 120 degrees with very little color.
Another dusting of coke and furnace sealed.
4:15 Furnace snowing. Slag white. Metal perfect and hot. Silicon figured at 0.35 per cent added. Furnace sealed.
4:30 Metal in proper condition and sufficiently hot.
Heat poured.

Bend tests, 180 degrees without any checks appearing.

crack on the bent area. The steels in series No. 2 only bent about 120 degrees before beginning to show incipient cracks; while series No. 1 gave only the same results at about 90 degrees. As this bend test is a standard comparison of ductility, it is easy to see where the above mentioned specifications could be met, and at the same time be filled with a steel of lower quality than desired.

The writer has followed this point carefully on several hundred heats and

TABLE XXXX

Tabulations of Manganese Scrap Charges

Manganese scrap per cent	50.0	70.0	80.0	70.0	50.0
Condition	Rusty	Rusty	Rusty	Rattled	Rattled
How Charged	Center	Top	Top	Center	Center
Current on	8:45 am	9:35 am	3:35 pm	3:35 pm	1:15 pm
Contact (pool)	9:15	10:05	6:05	4:00	1:40
Melted	11:10	1:15	7:35	6:15	3:45
Tapped	12:15	2:20	9:00	8:05	6:15
Total time	3:30	4:45	5:25	4:30	5:00
First charge:					
Manganese ore	none	12:00	6:35	4:55	2:45
Scale	10:55	11:05	6:45	6:05	3:45
Ca F	11:20	12:50	6:55	5:35	3:55
Lime	9:55	11:05	7:00	.....	3:05
Sand	11:15	1:05	7:25	6:35	4:25
Coke	11:15	12:55	7:35	6:35	4:25
Ferrosilicon	.....	2:05	8:55	7:00	4:35
Total pounds:					
Maganese ore	none	60	60	170	150
Scale	60	30	30	95	80
Ca F	20	15	25	40	40
Lime	85	145	190	215	250
Sand	15	30	25	25	15
Coke	85	155	85	110	120
Ferrosilicon	30	25	25	50	45
Ferromanganese	630	332	324	395	610
Final slag	...	...	Light Green	Light Green	Bluish Green
Final temp	60 sec.	40 sec.	60 sec.	40 sec.	45 sec.
Manganese per cent theoretical	13.43	13.29	14.14	13.22	13.25
Manganese per cent Actual	13.23	11.86	12.14	12.55	12.50
Carbon per cent	1.30	1.25	1.33	1.29	1.29
Side Walls:					
Before	OK	Thin	Thin	OK	OK
After	OK	Thin	Thin	Cut	Cut
Hearth:					
Before	Hole	OK	OK	OK	OK
After	Hole	OK	OK	OK	OK
Metal tapped	6430 lbs.	5655 lbs.	6010 lbs.	6200 lbs.	6400 lbs.
Kw. Hrs.	2500	2500	2500	3000	3000
Per ton	812	887	883	968	938
Time per ton	1:05 hr.	1:40 hr.	1:50 hr.	1:25 hr.	1:35 hr.

The following data cover 86 heats of intermittent operations:

Average pour of metal, 6708 pounds, or 3.354 tons.
Average charge, 6942 pounds, or 3.471 tons.
Melting loss, 234 pounds, 0.117 ton, or 2.55 per cent.
Average time of heat, 5 hours, 26 minutes.
Kilowatt-hours per ton of steel poured, 1002.
Kilowatt-hours per ton poured on first heat of day, 1055.
Kilowatt-hours per ton poured on second heat of day, 948.
Highest kilowatt-hours per ton of steel poured, 1385; lowest, 700.
Average manganese loss from total charge, 2.16 per cent.
Average manganese lost from ferromanganese, 1.26 per cent.
Average manganese effective from alloy, 98.74 per cent.
Average manganese in charge, 11.80 per cent.
Average manganese in steel, 11.63 per cent.
Average preliminary carbon using no shop scrap, 0.10 per cent.
Using small amounts of shop scrap, 0.26 per cent.
Average tonnage, 0.18 per cent.
Average pickup from 100 pounds manganese, 0.096 per cent.
Average manganese-carbon ratio, 10.77.
Average heats from roof, 25.
Average heats from silica lining, 35.
Electrodes per ton of steel poured, 33.8 pounds.

These data were collected during the experimental period on remelting manganese steel scrap, and it is natural that the results shown are not as good as have been obtained from later operations. These figures are given mainly to show various differences in the melting practices followed to determine results under changing conditions, and the effects of various additions.

always has found the following points to hold true:

A manganese steel containing under 11.00 per cent manganese always will fail on the bend test at some point between 90 and 120 degrees, regardless of the percentage of carbon, or the carbon-manganese ratio.

A manganese steel containing from 11.00 to 12.00 per cent manganese always will fail at some point between 120 and 180 degrees, regardless of the ratio or the percentage of carbon.

A manganese steel containing from 12.50 to 14.00 per cent manganese always will bend flat on itself, or 180 degrees, without any appearance of cracks, regardless of the carbon content or the ratio. While this gives a large leeway the higher percentage is not essential, a manganese of 12.50 per cent giving equal results with one of 14.00.

Therefore, in specifying manganese steel for parts where extreme ductility and resistance to shock is desired a percentage of manganese between 12.50 and 14.00 per cent should be demanded.

Gives Higher Limit

Manganese steels between 7.00 and 10.00 per cent manganese will have a higher elastic limit with a greater resistance to flowing under pressure, than the steels of the analysis, mentioned, but at the expense of ductility.

This specification also must include the fact that the carbon manganese ratio must not exceed 10.00. While it is comparatively easy to make steel fulfilling these requirements, it must be remembered that a certain amount of experience is necessary to keep the carbon down and the manganese up. If there were no ratio called for manganese steel could be made cheaper than at present, but the higher amounts of carbon present would be likely to cause difficulty in cracking during solidification. Often these cracks are interior ones, not apparent to the eye, and only come to light as a failed casting after the steel is placed in service.

The percentage of silicon present in manganese steel runs from 0.30 to 0.80 per cent, and varies greatly due to the percentage reduced from the slag. The ordinary addition before pouring is approximately 0.40 per cent. From the results of many tests it is not evident where silicon plays any part at all in this metal, outside of its final de-oxidizing powers. The writer has seen tests on different steels running from 0.15 to 2.00 per cent silicon give results so close that no difference could be noted.

However, the percentage of silicon should be kept between some such percentages as 0.30 to 0.60 as higher percentages in certain instances might influence the decomposition of the carbides of iron and manganese during the treating process. This is purely speculation anticipated by the action of silicon in the manufacture of *black heart* malleable which manganese steel closely parallels in several points.

Making manganese steel with soft steel scrap and ferro manganese is comparatively simple, but when it comes to using up the old shop scrap difficulties often are encountered. A great deal of experience is required if good steel of regular composition is to be made using shop scrap. Practically, it is impossible to segregate the shop scrap by heats, as this would take up too much valuable space. Consequently, this scrap either must be used as made or allowed to pile up until sufficient quantity is on hand.

Allowed to Accumulate

From experience it is preferable to allow the heads and gates to pile up until sufficient is on hand to make a heat containing from 50 to 75 per cent of this alloyed scrap. A heat containing this amount is easier to make than one of 100 per cent, although many fine heats have been made with a complete charge of old material. Using the scrap each heat requires more time and effort, and it is better to use one heat of large proportion than five or six containing smaller amounts. It is no harder to make a good heat from 75 per cent returned scrap than it is from 15 per cent.

The method of operating the furnace on these heats is similar to making the metal from carbon steel scrap with the following exceptions:

The greatest care must be exercised to prevent any electrode breakage, or any condition which would tend to raise the carbon in undue proportion, for if a high carbon is obtained it is impossible to lower it in the presence of such an amount of manganese.

No reliance can be placed on fracture tests, as regards the percentage of carbon present, for in the presence of over 2 or 3 per cent manganese, a fracture cannot be read with any degree of accuracy. Melters have claimed they could read the carbon on a manganese steel test, but yet the writer has to see one who can back up his boast. Several have failed miserably when actually confronted with the test.

Greater care must be exercised in keeping the slags as heavy in lime as possible, and yet in a fluid condition. This prohibits any additions of sand, and if too thick, fluorspar always must be used for thinning.

Ground coke to reduce the slag must be used with discretion as any careless additions are likely to penetrate to the metal and raise the carbon. Consequently it is seldom that a heat of returned scrap finishes under a white, powdering slag, the finishing slag usually being of a greenish blue.

Consequently more reliance must be placed on the appearance of the metal tests, and their degree of bending.

There seems to be no special manner in which the shop scrap should be charged, tests made giving equal results regardless of the position in which the scrap was placed. The character of the scrap, regarding its oxidized condition, is important, and the greatest care should be exercised to charge as clean scrap as can be had. Naturally, this follows if the chemical reactions involved in the

TABLE XXXXI

Comparative Results with Ore and Scale

RESULTS FROM ORE HEATS

Mn / C Ratio	Ore efficiency per cent	Bend on test bar	Mn in steel per cent	C in steel per cent
10.30	97.4	Very good	13.88	1.35
11.20	73.5	Very good	11.72	1.05
11.30	90.5	Fair	11.72	1.14
10.50	91.0	No good	11.09	.96
11.20	86.5	No good	10.76	.90
10.85	64.5	No good	9.76	.90
10.70	79.0	Good	11.24	1.05
11.65	101.0	Excellent	12.58	1.08
11.83	100.0	Excellent	12.08	1.02
11.85	90.0	Excellent	12.68	1.05
11.85	91.5	Excellent	11.97	1.01
10.15	96.5	Excellent	12.25	1.21
11.12	88.45		12.00	1.08

RESULTS FROM SCALE HEATS

Mn / C Ratio	Bend	Mn. in steel	C in steel
8.25	No good	7.98	.97
10.30	Good	10.99	1.07
11.40	Good	11.89	1.04
12.00	Fair	10.89	.91
11.10	Excellent	12.18	1.10
10.40	Excellent	11.94	1.15
11.05	Excellent	12.15	1.10
10.30	No good	10.66	1.03
12.10	Excellent	12.52	1.02
12.30	Excellent	12.58	1.04
12.30	Good	11.92	.97
10.50	Excellent	11.62	1.11
11.10		11.65	1.05

melting of this steel are considered.

If a heat containing 75 per cent shop scrap is charged, the approximate analysis of the charge in manganese will be from 9 to 10 per cent. It is impossible to lower the carbon greatly by the oxidizing action of rust, the result being that a great amount of the manganese is thrown into the slag. The less oxide present the less manganese in the slag, and the easier it is to clear this slag when reduction starts. Many experiments were conducted to investigate this point, and it always was found that the cleaner the scrap, the better the operating figures, and the higher the quality of the steel. It was found in many cases that it was economical first to place the charge in a rattler and free it of adhering scale before placing in the furnace.

The furnace being charged the current is thrown on, and the heat melted down as for any other class of steel, the only different point being that slightly larger amounts of lime are used at first. This is to supply some medium which will carry the large amount of oxides produced, and tend to prevent them from dissolving in the metal, which would be the case were no such medium present. As soon as the steel is melted, the walls are raked clean, and a test sent to the chemist for analysis of carbon and manganese. The result of his test will determine how heavy an addition of coke can be made for reduction purposes.

As the metal gets hotter more lime and spar are added, and the slag given a good dusting of coke. More or less of this coke may be added depending on the manganese-carbon ratio. The doors are sealed tightly and reduction commences. Tests should be taken at intervals to check this action. During this period the slag will change from a dark green, to one of a lighter color, but rarely will show white. When a slag of constant color is obtained, usually a pea green, the remainder of the manganese required, calculated from the previous analysis, correction being taken for future reductioon is added in the form of the ferro, and the finishing of the heat begins.

Metal tests first taken will show a heavy degree of color on fracturing, the colors ranging from violet, blue, green, and to the different shades of red. The first bends usually will be poor. However, as soon as the reduction begins to cleanse the metal, these conditions will change. The tests will give a greater degree of bend, and the fracture gradually will free itself of any color, and will, upon attaining its finished state, have a clear fracture, with the soft texture, and silvery lustre of a water quenched tool steel. Such a metal is in condition to pour.

During the finishing period, the viscosity of the slag will change, due to the large amounts of oxides being removed from combination, and much manipulation is necessary to keep this slag in a free flowing, liquid condition. This will necessitate frequent additions of either lime or spar, together with as much coke as is allowable. When the steel gets to the point where a good finished bend is obtained, another test should be sent to the chemist for his final analysis, and no heat ever should be poured without such a final safeguard.

Ore as a Deoxidizer

When ore, or mill scale is used to cut the carbon it is known that the manganese also is oxidized, and goes into the slag as MnO. Therefore, it was decided to try manganese ore in place of the iron oxide. Theoretically this would cut the carbon, and yet leave a high residual manganese in the steel according to the reaction:

$$MnO_2 + 2C = Mn + 2CO$$

This was tried using a heavy blue black manganese ore, analyzing 50 per cent metallic manganese. The comparison follows:

	Manganese ore	Mill scale
No. of heats	13	13
Av. wt. shop scrap	1421	1290
Av. wt. total charge	7225	6827
Av. wt. total pour	7028	6661
Av. melting loss, per cent..	2.7%	2.4
Manganese ore added per heat	36	....
Av. mang. in total charge	12.68%	12.53%
Av. manganese in steel	11.61%	12.11%
Av. carbon in steel	1.03%	1.09%
Av. manganese-carbon ratio..	11.29%	11.10%
Av. preliminary carbon	0.27%	0.19%
Av. carbon in charge	0.38%	0.37%
Av. carbon oxidized from steel	0.11%	0.18%
Av. kwh. per heat	3154	3384
Av. kwh. per ton of charge	876	936

From these experiments it was found that the manganese losses was greater with the ore. The preliminary and final carbons were higher, due to the fact that not as much carbon was oxidized. It required less power when using manganese. The manganese-carbon ratio was better with the ore, giving a final steel lower in carbon in proportion, even though higher at first. When the scrap was rattled, and free from rust, the results with ore were excellent.

This practice of cleaning the scrap and using manganese ore has not been adopted as standard practice. When used in this manner the ore is highly efficient.

Melting Steel Scrap in the Cupola

Question: Would it be possible for us to melt small pieces of sheet steel scrap, a few pounds per charge in our cupola?

We make stove plate and do not want to run any chance of affecting our castings in any way, but we would like to be able to use this material and get what we can out of it.

Answer: It will be possible for you to melt sheet steel scrap in your cupola furnace with your regular mix and you will experience no ill effect, provided the quantities are small and do not materially change the chemical composition in your metal. Sheet steel scrap in comparison to stove plate iron contains only small amounts of silicon and carbon which are the softening elements in cast iron. If you contemplate using as high as one to five per cent of the steel scrap in the cupola mixture, it will necessitate your allowing for the lowering of the silicon and carbon in the mixture by fortifying with pig iron high in these elements so as to maintain a uniform shrinkage and softness in the casting.

Issues New Booklet

H. H. Robertson Co., Pittsburgh, has published an attractive, 17 page illustrated booklet dealing with the building problems of today and offering solutions of such problems from the standpoint of the manufacturer of materials for construction. The booklet describes the different building products such as asbestos, protected metal for roofing, siding, partitions, gutters, downspouts, ridge caps etc. The companys ventilators and glazing construction are described. The company also offers engineering service on designing and construction. A number of examples of the company's work in the iron and steel industry, the railway field and chemical industry are given.

Plan Plant Extensions

The Reliance Electric & Engineering Co., Cleveland has awarded a contract to the Austin Co., Cleveland for building a new unit to its plant. The new extension includes a one story section saw tooth roof and a two story section both of mill type construction. The one story section is to be used to increase the machine shop and assembly departments and for finished stock storage. The two story section will be devoted to armature and coil winding department, This latest building program will make the fourth extension to its plant in the past 14 years.

The officials of the company are Clarence L. Collens president; H. Morley Hitchcock, vice president in charge of sales; A. M. Mac Cutcheon, vice president in charge of engineering; Lawrence Hitchcock, treasurer and C. V. Putman, secretary.

According to the biennial census of manufacturers 1923 compiled by the department of commerce, foundries producing malleable castings reported products valued at $117,386,866.

Bill Speculates on Universal Ignorance

BY PAT DWYER

LIVE and learn says the old proverb or the wise man, whichever is the proper authority on these standard sayings. From various sources extending over a period of many years I have gathered the general impression that the history of the human race has been divided into four well defined periods. Historians graciously admit that the periods merge into each other to some extent, but in a general way they claim that man has progressed gradually from the stone age to the bronze age, then to the age of iron and finally has arrived at the present wonderful era known as the age of steel.

Recently I read an article in which the author advanced the claim that iron was known at as early a period as bronze. Priority for bronze always has been claimed from the fact that bronze objects have been discovered which can trace their ancestry back further than any object made of iron. The author explains this discrepancy by the statement that iron oxidizes more readily than bronze and therefore the early iron objects have disappeared while the bronze has endured. In proof of his contention he cites instances of small iron tools having been found in a sealed chamber in one of the pyramids built 4000 B.C.

Personally, I have no intention of starting a fight over this point, but if any enthusiastic gentlemen want to get excited over it, they have my blessing to go as far as they like, provided they leave me out of it. My own humble opinion is that both bronze and iron have figured too extensively in warfare in the past without starting anything further in that line. I mention the subject merely to prove, as I said before, that the longer we live the more we learn. I always have been interested in the history of the early working of metal and naturally bronze commanded my respect and admiration as the oldest and most venerable. I am willing to accept the statement that iron may have been known in the bronze age, but I think further investigation will prove that bronze was the first metal that was melted and poured in a mold. The iron tools found in the pyramid were hammered.

The ancient amateur metallurgist who smelted the first lump of copper ore and poured the resulting metal into a stone mold to form a spear head was justly proud of his achievement, even if he did not realize to the full the value of the process which he inaugurated.

In the absence of any authentic record you are at liberty to form your own opinion or draw your own conclusions, but when you consider that man's primal nature, his habit of repeating, is the same today as it was in the beginning, I think I am reasonably safe in assuming that enthusiastic friends of the original spear maker arranged a subscription banquet that self same night to celebrate the event and do honor to our hero.

After they had polished off the bones of the mammoth and prudently laid them by in the event that clubs were needed later, they sat back on their hunkers while the local silver tongued orator lauded their metallurgical fellow citizen up to the everlasting and starry skies.

APPARENTLY HE DID IT WITH ONE HAND

With one hairy paw on his hip and the other toying gently with the girdle of teeth, human and from miscellaneous sources, that occupied the same relative position as the modern watch chain across his paunch, he directed the attention of the distinguished gathering to the fact that they were entering upon a new, a better and a brighter era. He had no hestitation in predicting that the new process so auspiciously begun that day practically would revolutionize methods connected with the arts of peace and war. He was particularly pleased with the reflection that undoubtedly it would give them the jump—so to speak—over their enemies in adjoining countries.

Pause here for loud cheers and cries of Attaboy, Erin-Go-Bragh and I'll tell the world with the eyes-er-slightly askew. Further cries of Speech! Speech! bring the guest of the evening to his feet.

He is practically in a state of coma so far as maintaining a grip on himself is concerned and yet at the same time by a curious mental process, is acutely concious of his pitiable condition. His throat is dry and every word of his carefully prepared reply has vanished as completely as the famous stuff referred to by the poets as the snows of yester year. A modern poet might be inclined to render the phrase as the foam of yester beer, but let us not quarrel over a trifle of that character. You know what I mean. He realizes that he can't deliver the goods.

Drops of perspiration ooze through his hide as readily as if he was a sponge instead of being one of the hardest boys on the reservation. They drip from the ends of his furry eye brows and from the lobes of his bushy ears. He can't see other drops but he can feel them, every individual one of them, slowly gathering on the two water sheds represented by his wide and hairy shoulders. He can

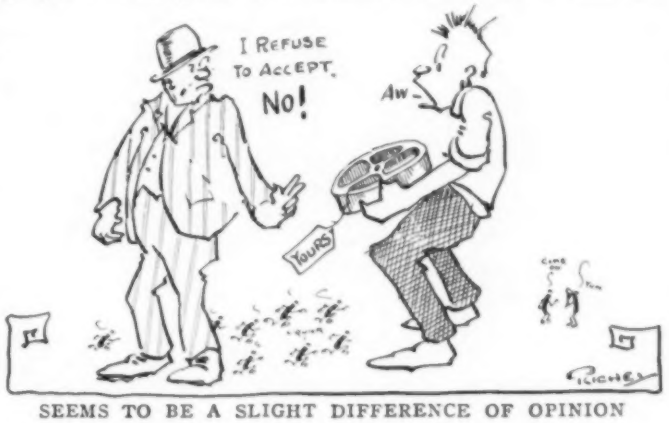
feel them uniting and trickling merrily down, jumping playfully from joint to joint along his spinal column. He begins to realize something of the significance attached to the epithet, you poor fish.

His cowardly legs threaten to cave in at the knees and he only manages to maintain an upright, or fairly upright, position, by clutching desperately at the edge of the festive board. If he was in a position to express an opinion, any kind of an opinion, he probably would experience no difficulty in finding another and more adequate method of describing the banquet table, the banquet itself and every feature connected with it. Fortunately, for us, he is helpless and the term festive board, therefore, will stand until annulled by competent authority, or until the average reporter thinks up a new term to replace the sterling old veteran. An occasional feminine eye peeping coyly from behind a convenient boulder increases his embarrassment and confirms him in his already firm conviction that the proper place for woman is in the home. Certainly she has no business snooping around, tittering, whispering and openly announcing through every glance from her merry blue eye that she is just as willing to laugh at the speaker as with him.

He glances furtively around the circle in the forlorn hope that his eye will encounter a friendly or sympathetic face and all he gets is a universal show-me stare that reduces him temporarily to a state of groveling imbecility. At this stage of the proceedings he looks and acts like a little boy unexpectedly caught in the jam closet. He devoutly wishes that the ground would open and swallow him and this is followed by the natural after effect of the same wish. He wishes, even more earnestly than in the first instance, that the ground would open and drop every person, absent or present, responsible for the banquet into the bottomless pit.

Of course, I realize you have consumed —or should I say wasted—some time in reading to this point, that is unless you are an experienced skipper who only hits the high spots, or one of these high powered lads who read on the run. In either case it should be unnecessary to remind you that the martyr went through the ordeal in less time than it has taken you to read about it. Once his mind had a grip on something definite, a vision of the entire gang being subjected to some fiendish form of torture that outranked his own, the cobwebs flew away, his faculty of converting his thoughts into language came back and he experienced no difficulty in haranguing the crowd to his own, if not to their satisfaction.

He gently deprecated the eulogistic tone assumed by the previous speaker and modestly claimed that what little he had done that day represented no extraordinary effort on his part. Any person might have done the same thing. He had come home early one day, see, to find the house empty, the fire out and the wife gone to a matinee. He wouldn't have minded that so much, see, but when he started to rake out the ashes from the fire place he found that in her hurry to get out she had left his favorite spear in the fire after using it as a poker. You can't trust one of 'em to handle a tool or an implement of any kind properly. The shaft was burned to ashes and the metal tip had melted into a shapeless blob on the hearth. Say, wouldn't that just naturally tie a double bowline hitch in your running gear?



SEEMS TO BE A SLIGHT DIFFERENCE OF OPINION

However, he sits down, see, and figures the thing out and the idea just comes to him that what has been done before can be done again. He goes to work, see, and hollows out a place in the hearth, the shape of a spear head. He builds up the fire and places the metal on top and melts it again. The metal runs down and fills the mold and there y'are, see? Nothing to it.

Bill came in while my mind was running along in this groove and I asked him if his ideas coincided with mine. On general principles I was reasonably certain he would disagree with me, but I was interested to learn his views on the subject.

"Well," said Bill, "I'll tell you. You may be right about the first spear head and then again you may be all wrong. I know one thing, if you attempted to make a casting in that manner today, you would have a sweet job on your hands trying to convince a customer he should accept it. However, I suppose everything has to have a beginning and according to all accounts the ancients made considerable progress in the manipulation of the metals at a remote period.

"I should not be surprised to learn that by the time the original spearmaker's son had succeeded to the business, competition had grown so keen that serious inroads were made in his golf activities by the time required to hatch up schemes to keep the jolly old establishment on its feet. Customers became more finicky over the quality and finish of the goods and also became adepts in shopping around and throwing the well known scare into each foundryman by telling him that his competitor was prepared to quote lower prices. You may claim that habits and customs must have changed considerably in a period extending over several thousand years, but take it from me, old son, man's primal nature including the bartering instinct, never has changed. The desire to drive a hard and a close bargain is as strong today, if not stronger, than it ever was at any time in the history of the human race. This condition is only natural since every advance in civilization has added to the comfort and convenience of man and increased the necessity of exchanging a correspondingly greater number of items. The wants of ancient man were few and practically all were within the compass of his own two hands. The wants of modern man are legion and he is dependant on his fellow men for supplying nearly all of them.

"Since he depends on the activities of other men for supplying the main requisites for keeping the old spark of life glowing in his frame, you might think he would familiarize himself with the methods involved in the manufacture of the various products. Does he? I'll say he does not.

"So rapidly and easily do we become accustomed to changed and improved conditions that the wonder of yesterday becomes the commonplace of today. We calmly accept everything *as is* and rarely bother our heads, as the saying goes, in speculating on the multitudinous activities of myriads of men responsible for the many conveniences we enjoy, or how our necessities are met as we pass through life in the endless race to make both ends meet in the present highly complicated scheme or system of civilization."

"Toot, toot, dear lad," I said, "or in other words, clap on the brakes. I am afraid your imagination is running away on a down grade. I don't think we are as dumb as all that."

"Where do you get that toot, toot stuff?" said Bill. "What do you think you are, a blinkin' old owl? It'll just take me 47½ seconds by any reliable stop watch to prove that—at least in some respects—you are about as dumb as a grandfather's clock. The *you*, in this

instance of course, is the old familiar third person plural and includes quite a few people.

"You can count the hours between meals and that just about lets you out. Do you know how your hat is made, or your shoes or the buttons on your vest? No, says you and you may lay to that. Have you any conception of the methods and machinery involved in making a needle, a spool of thread or a thimble. Profound silence in the front row. You don't know whether a knife and fork are chopped out of the rough with a hammer and chisel, or raised from seed in a hardware store. If a person asked you to describe the manufacture of an electric light bulb, the ring on your finger or your wife's ear rings you would find yourself up salt creek without a paddle. You don't know whether the holes in a salt cellar are punched or bored. You smoke cigarettes and you are as ignorant of how they are made and packed in containers as the veriest apostle of the blue laws is innocent of how to light them. Comparatively speaking and stretching the virtue of charity to the last half inch of its elastic limit you don't know nawthin'.

"Coming nearer home and right down to our own business the same thing holds true. Speaking generally, iron molders know nothing of steel or brass and the same may be said of steel and brass molders in relation to iron. Bench molders know nothing of heavy work and men who are quite competent to mold 100-ton castings could not hold a job for a day in a stove shop. Green sand men know no more than farmers about running up a brick wall for a loam job, while if you put a dry sand man on a green sand floor he will pound the sand so hard that the metal will fly to the roof and start a fire among the rafters.

Of course, this condition is due to modern methods with a constant trend toward specialization. It is necessary and will continue, but it seems to me it is to be regretted. At one time when a boy had served an apprenticeship at the ancient and honorable art of molding he was qualified to handle any job in the shop. If he was not, he could not lay the blame on the men with whom he had been associated during his period of probation. Afterward, he supplemented his initial training by traveling for a few years and working in various foundries where he learned other methods of doing the work with which he was familiar. Also he learned one or more branches of the trade that perhaps were not practiced in the shop where he had served his time. Eventually he became a master craftsman in the true sense of the word and was qualified either to make a casting himself or to supervise the activities of a foundry on an efficient and economical basis.

"I am willing to admit that not all competent mechanics are qualified to discharge the duties of a superintendent satisfactorily. Tact, knowledge of human nature, familiarity with business conditions and executive ability, largely are inherent attributes, but they may be developed if the root is there. A wide and comprehensive knowledge of the trade may be regarded as a fairly secure foundation on which a towering edifice may be erected."

"What are you going to do about it," I said. "Start a school?"

"I should say not," said Bill. "No school for your uncle William. As a kid I hated school when I was on the receiving end of the battery and now in my old age I have no ambition to shine on the pitching end. Any attempt to hasten or change the course of the natural evolution of the foundry is about as hopeless a task as trying to make Americans and English speak the same language. Do you remember the story of the English visitor accompanying his American friend down a lonely country road where they were suddenly startled by the hoot of an owl. 'My word,' said the lad. 'What's that?' 'Oh!' said the American carelessly. 'That's just an owl.' 'Just an 'owl! said the visitor in amazement. 'I know jolly well it's an 'owl, but what do you suppose the blighter is 'owlin' about?' "

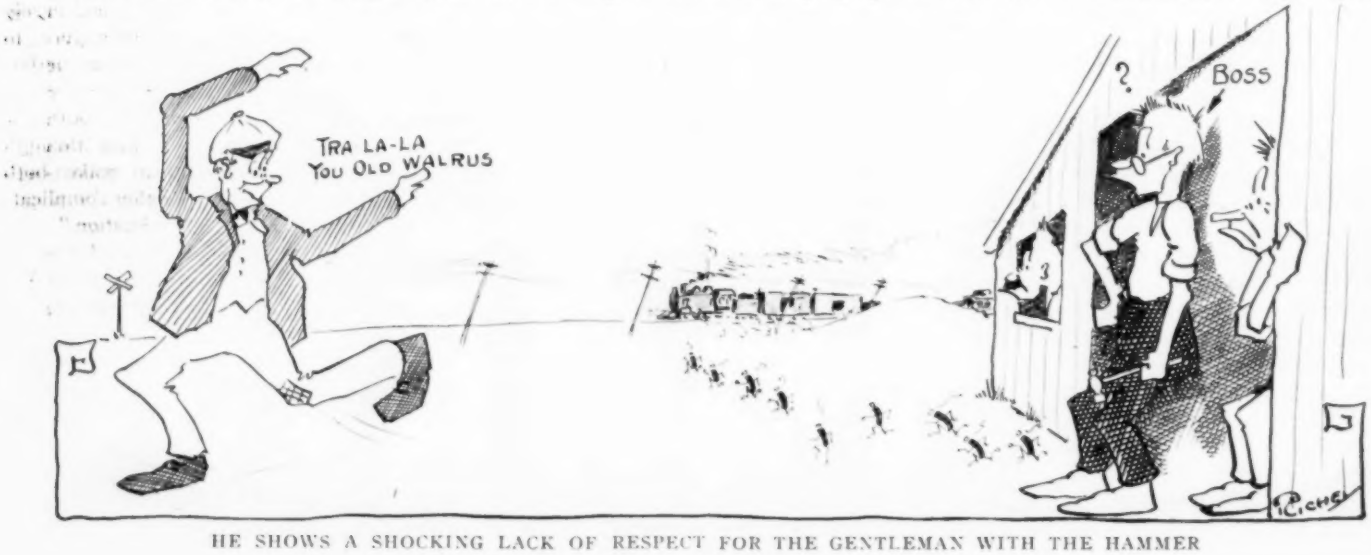
London Branch Meets

The annual dinner of the London branch of the Institute of British Foundrymen took place at the Engineers' club on Friday, Dec. 19. V. C. Faulkner, president of the London Branch and vice-president of the Institute of British Foundrymen, occupying the chair.

Among the principal guests were: R. O. Patterson, president of the Institute of British Foundrymen, Dr. J. L. Haughton, representing the Institute of Metals, Gerald Bagshawe of Gagshawe & Co., Ltd., Dunstable, Devon, malleable iron founders and manufacturers of chains, and J. G. Pearce, director of the Cast Iron Research association. After dinner a number of important subjects were discussed covering certain problems connected with foundry practice in Great Britain, such as labor questions, production costs, purchasing pig iron by analysis, etc. About 60 guests were present. The meeting terminated with a musical program.

Resigns Position

J. J. Brooks Jr., affiliated with the Harbison-Walker Refractories Co., Pittsburgh, for about 22 years, formerly as sales manager and later as assistant to the president, has resigned from any active participation in the operation of that company. However, he retains his place on the board of directors and will continue to co-operate in the affairs of the Refractories Manufacturers' association.



HE SHOWS A SHOCKING LACK OF RESPECT FOR THE GENTLEMAN WITH THE HAMMER

Charge Cupolas Mechanically

Handling Pig Iron, Scrap, and Limestone Is Facilitated by Mechanical Equipment from Unloading the Cars To Charging the Cupola in Ohio Pipe Shop

IN ALL industries the tendency of of the age is to improve the product and lower the cost of production. As the coast of labor practically is fixed, it is essential that the lowering of the cost of production be brought about by the standardization of parts, and the methods of manufacture, by the aid of mechanical devices.

The foundry industry during the past decade has made substantial progress by installing mechanical apparatus to promote intensive production. The larger foundries specializing in such commodities as car wheels, cast iron pipe, cylinders, etc., take the lead along these lines.

James B. Clow & Sons, Newcomerstown, O., specialize in the manufacture of cast-iron pipe. Their foundry is equipped throughout with modern mechanical devices to produce quality pipe in large qantities.

One of the outstanding features is the handling of raw materials, such as pig iron, scrap, coke, and limestone from the cars to the cupolas. All pig iron is purchased on specifications covering silicon, sulphur, phosphorus and manganese content, divided into three grades, governed by the percentage of silicon. Grade number one calls for silicon 1.50 to 2.00 per cent, grade number two, silicon 2.00 to 2.50 per cent, and grade number three, silicon 2.75 to 3.25 per cent. The average silicon content runs 1.75 to 2.25, and 3.00 per cent. A chemical analysis is made of each car of pig iron as it is received, previous to unloading. This enables the company to stack the iron in three large concrete containers or bins, according to the silicon grading and eliminates the necessity of stacking the individual cars.

All ferrous metals, such as pig iron, cast iron scrap, and steel scrap, are unloaded by a magnet made by the Electric Controller & Mfg. Co., Cleveland, attached to a 7½-ton yard crane, made by the Whiting Corp., Harvey, Ill. The scrap received by the company is railroad and No. 1 machinery scrap. The steel scrap is received in the form of bloom and bar crops, weighing approximately 15 to 50 pounds each, and is what is known as high silicon steel. This steel is purchased in two grades, designated as *low*, silicon 1.50 to 2.25 per cent, and *high* silicon 2.25 to 3.75 per cent. The advantage of using silicon steel scrap is that it makes the cupola mixture more uniform in silicon content, and eliminates the necessity of using large quantities of high silicon iron.

A standard brand of beehive oven coke is used for melting the iron in the cupola. This is purchased on specifications which require a high fixed carbon, low sulphur and ash content. All coke is delivered at the plant in hopper bottom cars. These are spotted over a ground pocket, or pit, situated between the tracks, which receives the coke. This is elevated from the pit by chain buckets, to the storage bin which shelters it from the weather. The buckets handle from 30 to 35 tons of coke per hour, and the capacity of the coke bin is 450 tons. Hoppers are attached to the bottom of the bin. Gates in these hoppers permit the coke to drop into the coke cars for delivery to the charging floor. In the yard, a great saving in labor has been effected by the use of the crane and magnet in handling the raw material. Five men now are doing this work in a satisfactory manner where previously 15 men were needed. This is an important item when the cost of labor and the ultimate cost of production is considered.

The limestone and coke are handled in cars. Limestone is stored in a pocket of the coke bin, holding 75 tons of this

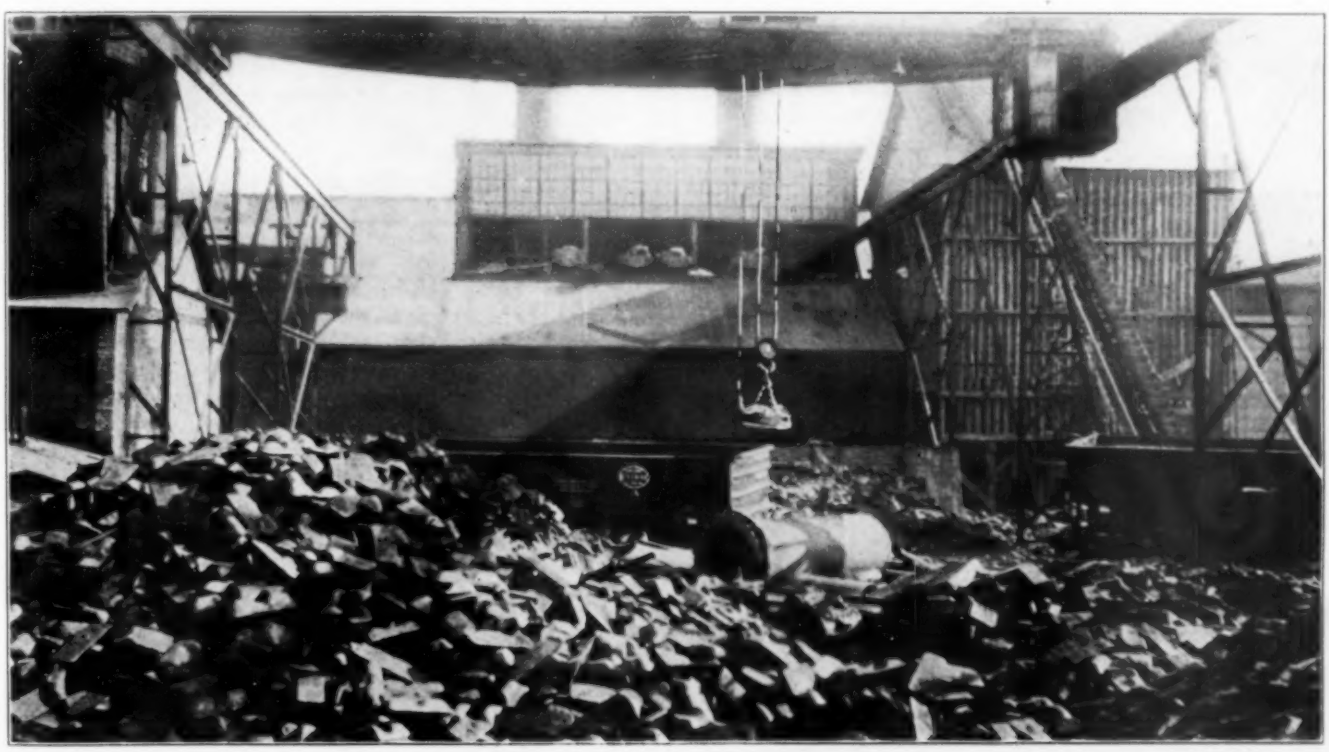


FIG. 1—VIEW OF THE STORAGE YARD SHOWING CRANE, MAGNET, AND COKE HOISTING APPARATUS

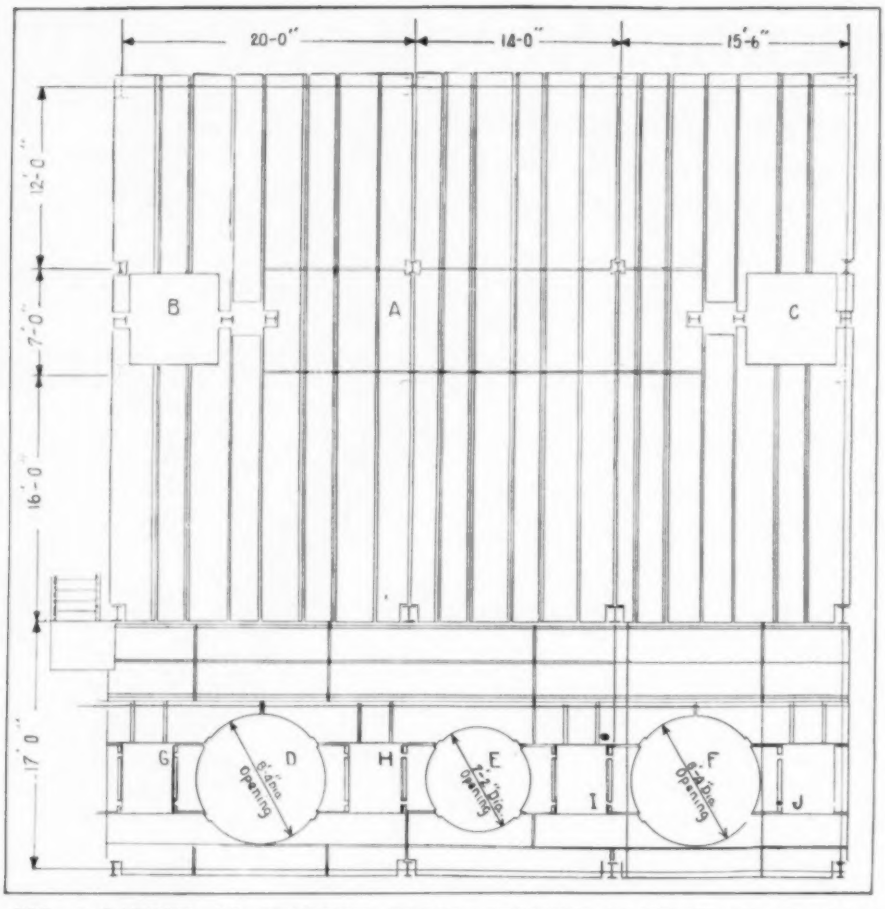


FIG. 2—LAYOUT OF CHARGING FLOOR SHOWING POSITION OF CUPOLAS AND ELEVATORS

material. These bins are so situated that the iron and coke charging cars have easy access to them by rail system.

The pig iron and scrap is placed on a standard 2-ton charging car in the proportion of 2500 pounds of pig iron to 1500 pounds of scrap, which is made up of *foreign* and *domestic* in varying proportions, including steel scrap ranging from 8 to 10 per cent of the total charge. These are carried up to the charging platform floor on elevators.

The coke cars are placed under the hopper attached to the coke bin, and charged with the required amount of coke. Then these cars are run onto elevators and raised to the charging floor. The limestone is charged into a separate car and delivered to the charging floor in a similar manner.

The charges of pig iron, coke and limestone are stored on the charging floor, which is sufficiently large to accommodate 25 per cent of the day's melt. A system of tracks provides for a rapid and constant movement of the cars to the cupola and from there to the elevators, for return. These cars are lowered to the ground floor and the charges replenished for a later period in the days heat. The layout of the charging floor is shown in Fig. 2. *A* designates the large space reserved for standard charging cars, *B* and *C* the space for the elevators. The raw material is received at *C*, and returned to the yard on elevator *B*. *D* and *F* are the positions occupied by the two cupolas in use at the present time. These were made by the Whiting Corp., Harvey, Ill.

These cupolas are lined down to 84 inches diameter. The cupolas are used alternately, melting from 160 to 170 tons of metal at a heat. The cupolas are charged in the following manner: Coke bed, 5600 pounds; iron, first charge 12,000 pounds. The alternate charges of coke and iron are 800 pounds to 8000 pounds. The amount of limestone used is gaged by the condition of the slag during the heat.

The space designated as *E* in Fig. 2 is reserved for the installation of a third cupola should the tonnage require it. The cupolas have two charging openings, as shown at right and left of cupola spaces *D* and *E*. At positions *G*, *H*, *I* and *J* four duplex charging machines are installed. These were designed, built, and installed by the Whiting Corp., Harvey, Ill. At the present time, the four machines are operated to charge cupolas *D* and *F*. The same number of charging machines will be able to take care of a center cupola, when it is installed, thus handling the raw materials for the battery of three cupolas.

Fig. 3 shows the side dump charging machine, ready to discharge the raw material into the cupola. In charging the cupola, the standard cars are pushed onto the hinged platforms, one on each side of the cupola, locked with a simple hook, which engages the loop on the car frame. The platforms and cars are raised together by compressed air, and the charges of pig iron and coke dumped into the cupola. The distribution of the raw material is under control of the operator at all points in the cycle. The charges

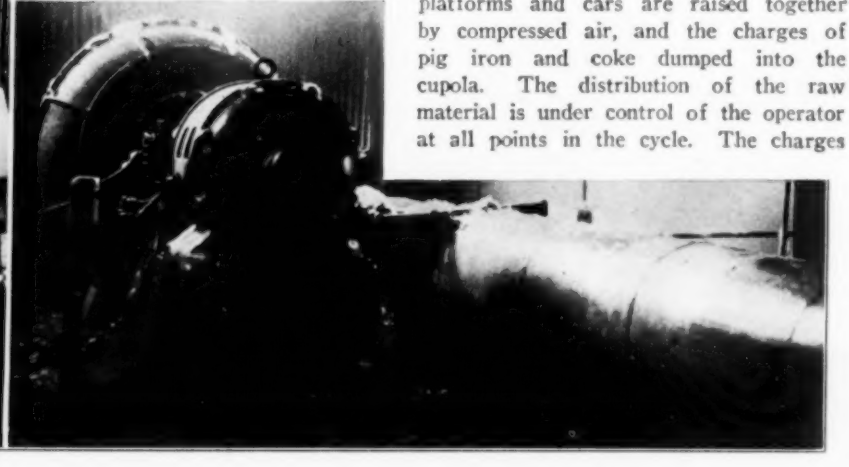


FIG. 3—SIDE-DUMP CHARGING MACHINE IN POSITION TO UNLOAD. FIG. 4—ONE OF THE TWO GAS BLOWERS USED FOR THE BATTERY OF CUPOLAS

may be delivered to the further side of the cupolas by a sudden hoisting movement, or to the near side by a slow hoisting movement. The charging spaces in the sides of the cupola are larger than the ordinary openings for hand charging and are set lower. An inclined chute is arranged to receive the stock when dumped from the cars. The charging machines are provided with apron plates, which overlap the chute, and prevent the iron and coke from dropping from the car to the floor.

In charging the iron, two cars each containing 4000 pounds of metal are dumped simultaneously into the cupola, giving an even distribution. The coke is charged part at the right opening, and part at the left, and not simultaneously. The limestone is distributed by hand.

Chain charging doors are installed at the openings of each cupola. These may be raised or lowered at will. The chain doors have an advantage over the brick-lined cast-iron doors, in that the former do not warp out of shape. The chain permits the operator to have a clear view of the inside of the furnace at all times and protects him from the excessive heat.

Cast iron blocks are used in place of the regular silicon bricks, 8 feet from the charging floor down, to resist the wear caused by mechanical charging. The layout of the charging floor with the mechanical charging device, enables two men to handle the 160 to 170 tons of metal per day of seven hours. Before the installation of this system, it required seven men to do the same amount of work.

The blast for the two cupolas is supplied by two blowers, manufactured by the B. F. Sturtevant Co., Hyde Park, Boston, Mass., one for each furnace, and cross connected to the cupolas. These blowers are situated on the mezzanine floor directly behind the cupolas. Fig. 4 gives a view of one of the two blowers described. A recording ammeter is installed on the mezzanine floor, which records the power utilized by the blowers and indirectly denotes the amount of air entering the cupolas at any given time.

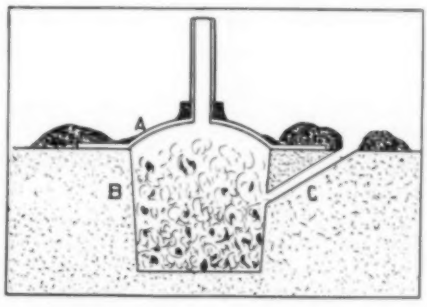
The building containing the cupolas, blower, elevators, etc., made up of the ground floor, mezzanine and charging floors, is as fire proof as it is possible to make it. It is constructed of structural steel and concrete. The roof is covered with cement tiles, and the floors are built of steel plates supported by *I* beams. Fig. 1 gives a view of the yard showing the crane, magnet, coke hoisting apparatus and raw material. The end of the charging floor also may be seen. It is so situated that should any mishap interfere with the elevator service from the ground to the charging floor, the pig iron, coke and limestone may be delivered directly from the yard to the deck.

Foundry Lighting in the Earlier Days

BY ROBERT E. MASTERS

YEARS ago in the foundry industry when it rarely happened that the working day was less than 10 hours, and more often longer, during the winter months men would stumble along in the dark with a ladle of iron, or they would be guided by a lighted skimmer when taking off a heat. Light was one of the things that the foundry was supposed to get along without, little or no provision being made to furnish the building with artificial illumination. Incidently many plants were not dazzled with daylight. The writer often has seen molders trying to catch a gleam of light in mirrors to throw into the deep parts of the mold to ascertain if there were any loose sand to be taken out or any broken places to mend. The author remembers 50 years ago of molders going down a dirty, ill kept alley and about half way between the two streets entering through a low basement like door the badly lighted foundry of a then famous turbine water wheel plant. Yet these molders were expected to produce good work.

In the early seventies the writer was connected with a foundry that had no lighting system and no method of getting illumination. The shop operated 10 hours a day and all through the winter months the shop was dark for nearly 2 hours of the working day. For this reason it was dangerous to carry iron to the pour off. Lanterns and reflectors soon were made useless by steam and dust. In an effort to provide a means of illumination, some plates were cast as shown in the accompanying illustration at *A*. The diameter of the plate was 30 inches, the diameter of the coned section 18 inches and the length of the flange 6 inches. The hub of the plate was threaded with a 1½-inch pipe 6 feet long fitted into it and standing upright. A hole was dug in the floor as shown at *B* and filled to the floor level with slack coal, fitting in a sprue at *C*. The plate was set over the hole filled with



SIMPLE METHOD IS EMPLOYED TO ILLUMINATE THE FOUNDRY

coal and the flange covered with sand to make it air tight.

When time to light up, the sprue was withdrawn and some iron poured in with a hand ladle. In a minute or two a lighted skimmer was touched to the end of the pipe and a light resulted that would make Edison feel proud. Two of these spaced to the best advantage illuminated a 60 x 100-foot foundry so that the men could carry the ladles around in safety. The flange was made so deep for two reasons, namely that it helped make the pit air tight and prevented the sand from caving in on the coal when a molder stepped near the hole. The coal was not a total loss since a good proportion was coke and could be used.

Dolomite for Refractories

Research work on the utilization of dolomite in refractories is being continued at the ceramic experiment station, Columbus, Ohio. The main problem being studied is to combine the lime in the dolomite so that it will be nonslaking and at the same time will hold up the refractories, thereby rendering available abundant deposits of dolomite for use as a basic refractory. Work previously done by the bureau of mines on different fluxes for rendering dolomite refractories nonslaking indicated that by careful selection and preparation refractory bricks could be made, one of the best fluxes tried being alumina-iron flux. As the result of more recent work, a composition has been found which, when compounded with the proper binder and burned after a given procedure, produces a strong, nonslaking brick of high refractoriness.

The Smith & Woodbury Co., 55 Second street, Portland, Oreg., will represent the Chicago Pneumatic Tool Co. in Oregon and Southwest Washington carrying a stock of pneumatic tools, air compressors and engines. A service department will be installed.

How and Why in Brass Founding

By Charles Vickers

Use Rosin in Aluminum Casting Cores

We desire to learn a mixture for making cores for aluminum castings that will leave a smooth surface, also a mixture for a soft core that will eliminate hammering to get it out of the castings.

A mixture consisting of three parts fine sharp sand, one part of molding sand, bonded by one part of powdered rosin to every 15 parts of the mixed sands makes a good core for aluminum alloys. The sands should be mixed dry, the rosin incorporated and the mixture damped to a working consistency. The cores must be heated until the rosin melts and smokes. When the cores are cold the sand will be cemented together by the melted rosin. It is a good plan to spray the cores while green with molasses water. If they are too hard when cold, decrease the amount of rosin and use one part to every 20 of mixed sands, or even less. Should the cores be too weak to handle green for some jobs, simply use less sharp sand and more molding sand, thus securing a tougher mixture when green. Cores made with rosin leave the casting easily while it is hot.

Reclaiming Zinc Dross

We would like to know how to reclaim the zinc dross, zinc skimmings and ashes from our galvanizing plant, as we are ready to install an oil-fired kettle furnace, both for remelting scrap zinc and for reclamation purposes.

The zinc dross should be melted in a kettle and heat applied until it is as fluid as possible, but it must not be so hot it fumes, otherwise it will attack the iron of the kettle. The pasty zinc then is treated with potassium cyanide, sulphur and steam to remove the iron, which acts to make the zinc thick. In actual operation the refining is done by a mixture of scraps of leather, chopped raw potatoes and sulphur. The leather is a cheap source of cyanide, the potatoes of steam and the sulphur is used as flowers of sulphur.

This mixture is thoroughly made, then small portions are enclosed in suitable perforated containers having a handle to enable them to be plunged to the bottom of the molten metal and be held there, as long as they cause ebullition. Several of these containers should be on hand as a constant boiling of the zinc is required, which is accomplished by immersing a new container as the old one ceases to give off gases. The zinc should not be boiled so strongly it is thrown out of the kettle, but a steady ebullition is kept up for a period that may vary from 15 to 30 minutes, or until the zinc becomes fluid.

The dross that rises to the top of the metal may be skimmed off at intervals, but the iron will be sulphurized and sink to the bottom of the kettle as matte. The fluid zinc is dipped out or drawn off and ingoted.

Should the refined zinc require deoxidizing, this is done by an alloy of zinc with 5 per cent aluminum, of which one half pound is added to each ton of remelted refined zinc.

Making Bearings for Converter Shafts

We have orders on hand for bearings for conveyor shafts so situated they cannot be lubricated, but the shafts run very slowly; what mixture would be suitable? At present babbitt bearings are in use, but we are going to experiment with brass, and it must be soft enough to reduce the wear on the shaft to the minimum, and also last longer than babbitt.

A suitable mixture for such a purpose will be copper 50 per cent and lead 50 per cent. If there is any difficulty in making such an alloy use copper 65 per cent, tin 5 per cent and lead 30 per cent.

White Brass Mixture

We wish to obtain a mixture for white brass for builder's hardware. The alloy must not be too hard or too soft, as it has to be peened to make hammered hardware.

The following alloy will probably be found suitable:

VICTOR METAL

	Per cent
Copper	50.00
Nickel	15.00
Zinc	35.00

Use 30 per cent of an alloy of half nickel, half copper to carry the nickel into the mixture, and after the zinc has been added, put in 2 ounces of aluminum as a flux. Pour the alloy cool.

Brass Castings Cleaned by Acid Dip

We would like to obtain a formula for cleaning brass castings by dipping into acid.

The castings first must be free from grease, and one way of insuring this requirement is to wash them in a hot solution of caustic soda, common lye and water. If the castings are free of grease they do not require this preliminary cleaning. However, it is advisable to sand blast the castings, before dipping as they will appear smoother and more finished afterward. A bright dip for brass that is much used consists of equal parts of commercial nitric and sulphuric acids, with 2 gallons of the mixed acids added to 2 ounces of hydrochloric acid.

As the acids act energetically the brass is held under the surface only for about one second. It is washed in running cold water, after which the brass usually shows a tarnish, due to oxidation. This is removed by the cyanide dip consisting of a solution of 1½ pounds of potassium cyanide in 20 gallons of water. This latter solution is poisonous. After the castings have passed through this latter dip, they are washed in cold water, then in hot water and followed by drying in hot sawdust. If much of this work is to be done, and no chemist is employed, it will be the part of wisdom to employ a practical electroplater.

Match Plate Mixture Uses Zinc and Tin

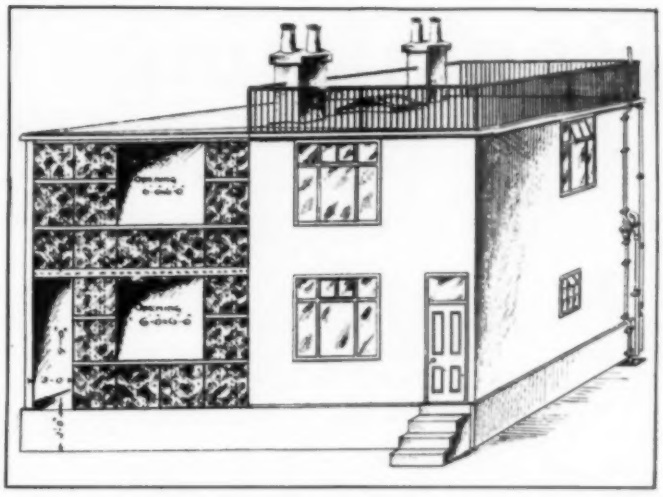
We like to know the mixture used as white metal in making match plate patterns from a standard pattern which has no shrinkage.

The mixture that finds most favor for the purpose outlined consists of equal parts of tin and zinc. Thus take 50 pounds of zinc and melt it in a crucible that will hold twice as much. Do not allow it to get hot enough to smoke, but when completely molten scatter a little sal ammoniac on the surface of the zinc to clear away the dross. Then throw in a piece of sheet aluminum 1½ inches square and as thin as is used for the sheet metal kitchen utensils. Let it dissolve and add the tin gradually. Pour the metal at as low a temperature as will fill the mold completely.

When a little harder metal is desired, deduct 2 pounds of tin and add 2 pounds of metallic antimony to the mix.

British May Build *Cast Iron Houses*

By Joseph Horton
British Correspondent The Foundry



Perspective View of Proposed Double House Before and After Adhesive Covering Is Applied to the Outside

GREAT BRITAIN has been suffering since the war from an acute shortage of houses, especially for the working classes and many schemes have been proposed to alleviate this condition. The British government is offering subsidies to local authorities to carry out a building program extending over a period of several years. Private enterprise also has been encouraged. The most original scheme advanced is the design of James A. Potter, Tentor Foundry Co., Ltd., Ferham Works, Rotherham, Yorkshire. He proposes to build houses of cast-iron plates and has volunteered to furnish details of the structure.

Cost figures are not yet available, but great stress is brought to bear on the argument that unskilled labor can be used for the erection of these buildings. The scheme also furnishes a partial solution to the housing and unemployment problem. The accompanying illustration shows details of construction. Houses of semi-detached parlor type will be constructed in pairs each containing about 850 square feet of floor space distributed as follows: Living room 9 x 12 x 15 feet, parlor 9 x 12 x 15 feet, passage entrance 3 x 6 feet, stairway from passage to landing 6 x 9 feet, bathroom 4 x 5 x 9 feet, three bedrooms each 8 feet 6 inches x 9 x 15 feet.

The living room will be fitted with a kitchen stove with water heater for the sink and bath. The front room will have a stove mantel register with tiled panels and the front bedroom a similar stove. The bathroom will be provided with a 5-foot porcelain tub, a lavatory and a toilet bowl. The middle room will be furnished with a manhole having glass light in the ceiling and the flat roof will be built of reinforced concrete properly channeled. This type of roof is recommended because in a crowded area it may be enclosed in a palisade or fence to serve as a playground for the children.

The proposed building unit is a 3-foot square flanged plate with facing strips on the outside of the flanges to ensure a tight joint. The outside surface of the plate will be provided with either depressions or projections and will be made slightly concave to increase the strength and to furnish a foundation for the outside adhesive covering.

Plates Are Bolted

Four holes, or if necessary a greater number, are cored or drilled through the back of the plate to secure wood strips firmly in position between the flanges on the inside of the plate. These struts are intended to serve the double purpose of reinforcing the plate in vertical plane, while serving as a foundation for the laths carrying the internal adhesive covering.

Recesses are cast parallel to each other on the edges of the flanges for receiving the laths which in turn are attached by nails or screws to the wood struts. The outer plate may be secured either by bolts or other suitable means. The remaining outside edges of the plates will be slightly rounded to fit the fillet in the angle of the reinforcement members.

Outer and inner walls are to be built of panels of flanged cast iron plates reinforced by *T* and *I.* steel beams through which the connecting bolts pass. Each unit will be supported independently of its neighbor and will not be overloaded in the event of an accidental fracture of an adjoining unit. The sills will be made from 3 x 3-inch angles 5/16-inch thick and the corner posts will be formed from 4 x 4-inch angles. Flat bars 6 x ⅜ inches with two 3 x 1½-inch angles will serve as a tie band and a bearing for the floor joints.

A 3-foot trench filled with concrete is designed to serve as a foundation for the building. An angle iron on the foundation is held in place by long bolts bedded in the concrete and long enough to extend upward through the first flange of the wall plates. The lath and plaster covering on the interior of the building provide an air space in the wall that will insulate the rooms against dampness. Cement, stucco, rubber or cork composition may be spread over the external surface of the plates and to form a weather proof covering. As a final argument the inventor points out that when the houses have outlived their usefulness, or, have to be dismantled for any purpose, the scrap value of the material will amount to quite an item.

Costs Topic of Dinner In Philadelphia

At the January meeting and dinner of the Philadelphia Foundrymen's association held at the Manufacturers club, Wednesday evening, Jan. 14, M. J. House, M. J. House Associates, New York, described a system for the uniform cost accounting in iron steel, nonferrous foundries and machine shops. R. H. Spare, cost engineer of the Franklin Howard Co., Philadelphia, discussed the errors made in foundry inventories showing incorrect income returns and advised the best methods of correction.

Announce Fellowships

The University of Illinois, Urbana, Ill., has announced 14 research graduate assistantships in the engineering experimental station. Two of these are under patronage of the Illinois Gas association. Appointments are made by the director of the station, M. S. Ketchum, dean of the college of engineering. Applications for the appointments will be accepted until April 1, 1925.

The offices of the Republic Carbon Co. Inc., are being removed from Milwaukee to the works of the company at Niagara Falls, N. Y.

Reclaiming Molding Sand

Tests Show That Mulling Increases the Bond of Heap Sand, Refuse, Reclaimed Mixtures, and New Sand Mixtures Which Are Important Factors in Reducing Foundry Costs

BY F. L. WOLF AND A. A. GRUBB

IN THE latter part of 1922 the Ohio Brass Co. started experiments to reclaim waste sands which were passing from the brass foundry to the dump. An account of the preliminary work and first practical trials was given in a report presented at the Cleveland convention of the American Foundrymen's association in 1923. Two molding floors were operated entirely on reclaimed sand during the following summer, with other floors operated on new sands. The results obtained were observed carefully. An account of these trials and observations was reported to the joint committee of molding sand research in October, 1923.

The refuse sand which we reclaimed consists of the fine material from foundry floor sweepings. The cores, core wires, scrap brass and spillings are hand picked and screened out by a screen with 8 meshes to the inch. About 260 pounds of this fine material are produced per week by each floor. It has a bond value of about 135, a figure entirely too low for molding purposes.

In the first experiments at reclaiming this sand, it was mixed with fine medium bond sand from northern Ohio. This served to build up its bond but also tightened the sand. The grain size was too small. A high bond but larger grained material was needed. The Gallia county, Ohio, red sands offered possibilities, so were tried out experimentally. Table 1 gives data on several sands used successfully in the experiments. The figures are average values. The local No. 1 and No. 2 sands are produced in northern Ohio and were used as substitutes for the No. 1 and No. 2 Albany sands because of lower freight rates. The class of work made in our foundry requires a bond value between 150 and 180 grams and permeability between 17 and 25, depending on the class of work. The grain size of the local No. 2 and the Gallia sands appealed to us because they tended to keep the heaps open.

A number of combinations were made up and examined. Gallia sand was mixed with the refuse to renew its bond. The local No. 1 sand was added to reduce grain size and tighten the sand for smooth surfaces, while the No. 2 sand was used when greater permeability was required. The mixtures were tried out on experimental molding floors under close observation. The quality of lift and the number of stickers, drops, etc., were noted and casting losses due to dirt and misruns were observed. The mixtures and rebuilds best suited to the requirements of the work thus were studied.

Data from these experiments are given in Table 2 and the chart Fig. 1.

Give More Data

AT THE October, 1924, meeting of the A. F. A. held at Milwaukee, F. L. Wolf and A. A. Grubb, Ohio Brass Co., Mansfield, O., presented a paper on molding sand reclamation and control experiments. This paper is abstracted herewith. Since the paper was read the authors have received a number of inquiries about the apparatus and methods used. Owing to the great interest shown in moisture control work, A. A. Grubb has prepared an article dealing with systematic control of the moisture content of foundry sands. This will be published in an early issue of THE FOUNDRY.

Various sands and combinations of sands were mixed thoroughly with the machine made by Royer Foundry & Machine Co., Wilkes-Barre, Pa., marked *R* in the table or screened, marked *S*, in the table and then sampled. They were then mulled for various periods and samples were taken after each period.

Maximum bond was obtained only after 50 to 75 minutes in the mulling machine. These long periods may have been due to the small size of the muller, but nevertheless, they indicate that a considerable amount of work is required to distribute the bonding material on the sand grains. Mulling for as short periods as 8 to 10 minutes tightened nearly all the samples as shown at the foot of the table. Continued mulling made but little further change. No. 8 was the one exception. Its permeability increased from 30 to 40 and then dropped to 23. Several samples were put through the aereating machine after the mulling process. This served to open them up 6 or 8 per cent at a small sacrifice in bond. Sand which has been thoroughly mulled and then passed through an aereating machine or riddle is in excellent condition for molding.

Mulling alone without addition of new bonding material, served to restore considerable bond strength to refuse sand, as shown in curve 2 of Fig. 1. This sand gave satisfactory service in making small brass castings for a few heats, but deteriorated rapidly. Ordinary heap sand, curve 1, Fig. 1, with a bond of 160 was mulled to a value of 203 in an hour. Its working properties were improved greatly and the effect on molding losses was evident for several days.

Sand mixtures Nos. 3 and 4, Table II, were found satisfactory for rebuilding molding heaps. One or two wheelbarrow loads were added each week; No. 3 sand if the heap sand was sufficiently open, No. 4 if too tight. If weak in bond and yet tight, more No. 2 sand was used. These mixtures and similar ones containing different proportions of refuse, Gallia and the two local sands have been in regular use, in our foundry, replacing the more expensive eastern sands with marked success during the past year.

The long period of mulling necessary to develop maximum bond operated against the praticability of the method. Therefore, attempts were made to use the mixtures without mulling. They were put through the aereating machine and then introduced into the heaps or else introduced as the entire sand heap was put through the machine. When added in small quantities at frequent intervals, the bond value of the heaps was maintained so long as they were not used too severely. Fairly good results were obtained for several weeks. The handling of the sand seemed to develop some of the bond and fast enough to offset that burned out. The best and quickest results were obtained on badly burned out floors by putting the entire sand heap through the muller, adding the rebond and refuse sand in the process. It was impractical to leave the batches in the muller long enough to develop maximum bond but 5 to 10 minutes gave good results.

To study the effect of mulling on the

physical characteristics and working properties of sand and to study the relation of certain proposed methods of test to working properties, several of the sands and sand mixtures of Table II were examined further. The samples were tested according to the standard A. F. A. methods for permeability, bond, fineness and dye adsorption value. The same samples were tested for bond by two rapid methods with which we have been experimenting for routine control work and by the Smith vibratory method. The data obtained in two sets of these tests are shown graphically in Figs. 2 and 3. Fig. 2 gives the values obtained on sand mixture No. 3 of Table II, 60 parts refuse, 30 parts local No. 1 and 10 parts Gallia sand. Fig. 3 shows results on mixture No. 5, 90 parts local No. 2 and 10 parts Gallia.

Line *S* on each chart represents the bond values as determined by the standard A. F. A. method. The No. 3 mixture was tried out on two molding jobs without mulling. Losses due to dirty castings were heavy and the sand was pronounced unsatisfactory. When mixed thoroughly with good heap sand, half and half, it gave fairly good results. The bond value was 152. After mulling No. 3 sand for 8 minutes it was used for difficult molding with marked success; no losses which could be definitely ascribed to the sand were made. After a still longer period of mulling it was used on some of the most difficult jobs with excellent success. Our experience indicates that the standard bond test is closely related to the working properties of the sand and that it measures a property which is one of the determining factors in the production of dirty castings.

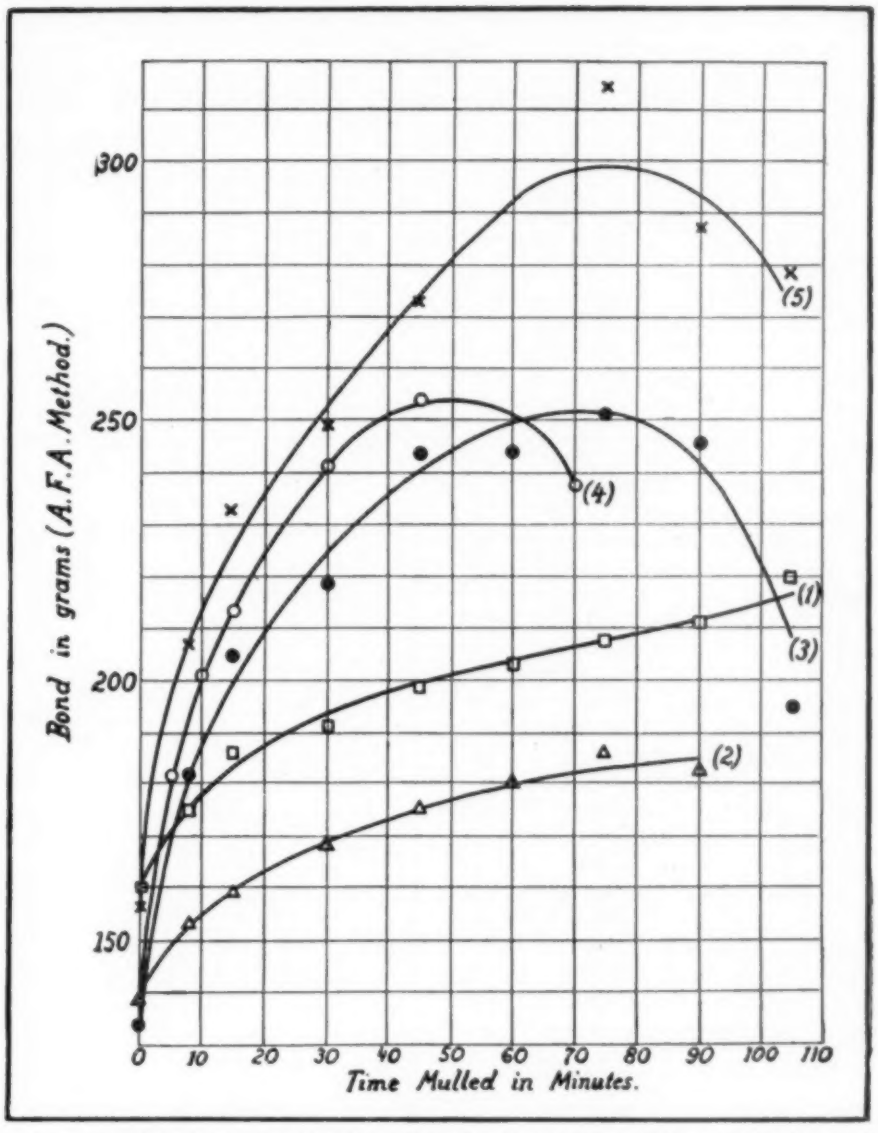


FIG. 1—EFFECT OF MULLING ON BOND OF VARIOUS SANDS AND SAND MIXTURES—NUMBERS REFER TO TABLE II

Line *B* represents bond values measured by one of the rapid methods. Test specimens, 1 x 1 x 12 inches in size are rammed by hand, using only a two part corebox and a core maker's mallet and trowel. These are pushed slowly over the edge of a plate or table and the average length of the broken pieces is taken as a measure of bond. This method is rapid and has been successfully used for core sand control work in our foundry during the past four years and for molding sand work until recently when it was replaced by the tensile method described later.

Line *T* represents values obtained by another rapid method which promises to be of value for routine check and control purposes. The same specimen is used for both permeability and the bond tests. A sand cylinder is used consisting of two parts which are firmly clamped together while the specimen is prepared and tested for permeability. The clamps are then removed and the cylinder is pulled apart by a tension device built on a rammer stand. The sand specimen is broken at its mid point. A spring balance is calibrated to register the tensile strength per square inch.

It is evident that the three methods of test for bond or strength are closely related. The tensile test shows greater difference in the relative strength of two given samples than either of the other tests. The permeability determinations made with a two part cylinder are sufficiently accurate for practical purposes even after the parts have suffered wear from several hundred determinations.

Line *G* in the charts represents the average grain size, that is, the mesh of the screen through which the average grain would just pass after the clay substance, represented by the line *C*, has been removed by the standard A. F. A. method. Line *D* shows the dye adsorption values of the samples. In all the tests the grain size and clay content as well as the dye adsorption value remained practically constant throughout

Table I

Various Sands Used for Test Purposes

	Heap sand	Refuse sand	Albany No. 1	Albany No. 2	Local No. 1	Local No. 2	Gallia
Permeability	20	23	20	40	19	45	103
Bond	160	135	170	155	165	153	355
Tensile strength	128	92	150	125	140	120	751
Fineness of grain	134	125	150	105	178	87	86
Clay (A. F. A.)	7	6	8	7	8	9	27
Clay (vibratory)	25	20	18	14	21	9	74
Dye adsorption	130	110	160	160	220	260	1700

Table II

Records Different Sand Combinations

Mixture numbers	1	2	3	4	5	6	7	8	9
Per cent heap sand in mixtures	100	...	...	...	...	...	...	...	...
Per cent refuse in mixtures	...	100	60	60	80	88	85	80	95
Per cent Local No. 1 in mixtures	...	...	30	...	...	...	...	...	...
Per cent Local No. 2 in mixtures	...	...	...	30	90	...	...	...	...
Per cent gallia in mixtures	...	...	10	10	10	12	10	10	..
Per cent Albany No. 2½ in mixtures	...	...	...	...	...	...	5	10	...
Per cent Albany slip in mixtures	...	...	...	...	...	...	...	...	5
Method of mixing	S*	S	R**	R	R	R	S	R	S
Bond of mixture	160	139	134	139	156	133	144	133	138
Perm. of mixture	20	28	23	26	45	25	20	30	19
Bond after mulling 10 minutes	178	155	190	198	212	169	158	143	178
Perm. after mulling 10 minutes	19	23	19	21	43	19	19	37	16

*Screen method.
**Royer method.

the entire period in mullings the bath.

The Smith vibratory test, line *V*, gave results which in some cases were comparable with the clay substance obtained by the A. F. A. screen method; in other cases, heap sand and refuse sand as given in Table I showed a marked difference. The vibratory test usually gave higher values. On sand mixtures No. 5, Fig. 3, the results were rather erratic so the samples were treated with dilute caustic solution, shaken, neutralized with acetic acid and then vibrated and allowed to settle according to the Smith method. The average results are represented by the line *R*. They are considerably higher than those obtained without the use of a defloculating agent, indicating that the original method probably does not completely break up the aggregates.

Potential vs. Sensible Bond

The data collected thus far by the various investigators point only to general conclusions regarding the relation between average grain size, clay content, dye adsorption value and bond. It is evident that fineness, clay, colloidal matter and moisture determine the strength of sand, and there may be other factors. No definite relation has yet been established; the field is a fertile one for investigation.

The fact that by mulling samples of sand we were able to develop greater bond while the other characteristics mentioned previously remain constant, indicates that possibly these characteristics determine the *potential bond*, or the maximum strength which can be developed in a given sample. The *sensible bond*, or the actual strength existing at any given time, is determined by the distribution of the particles as well as their size, quantity and composition and is measurable only by strength tests of some kind. In producing sand or in purchasing it we are interested primarily in the factors which determine potential bond, namely fineness, clay, dye adsorption value and perhaps others. On the other hand, in using it on the molding floor we are interested mainly in the sensible bond—the bond strength actually present.

One man devotes full time to sand control and reclamation work. He is held responsible for the condition of the sand heaps in our brass foundry and makes all additions of sand. Additions are determined by the size of the heap, the bond and permeability of the sand and the type of job being molded, so the man has a real life size job. He works in close conjunction with the floor bosses, or instructors as they are called, each of whom have charge of several molding floors.

To facilitate this man's work we have placed specially constructed test

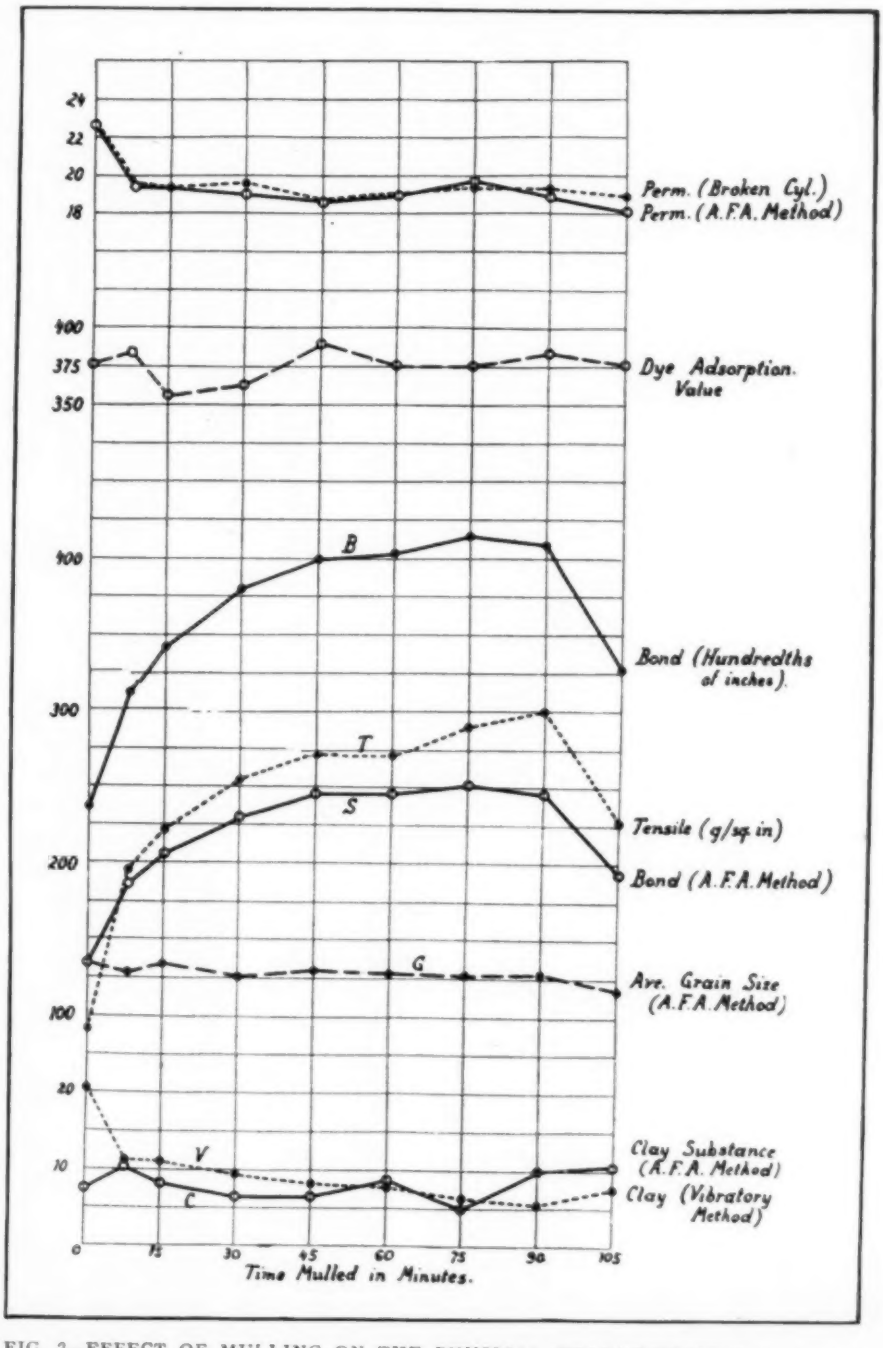


FIG. 2—EFFECT OF MULLING ON THE PHYSICAL CHARACTERISTICS OF SAND MIXTURE NO. 3

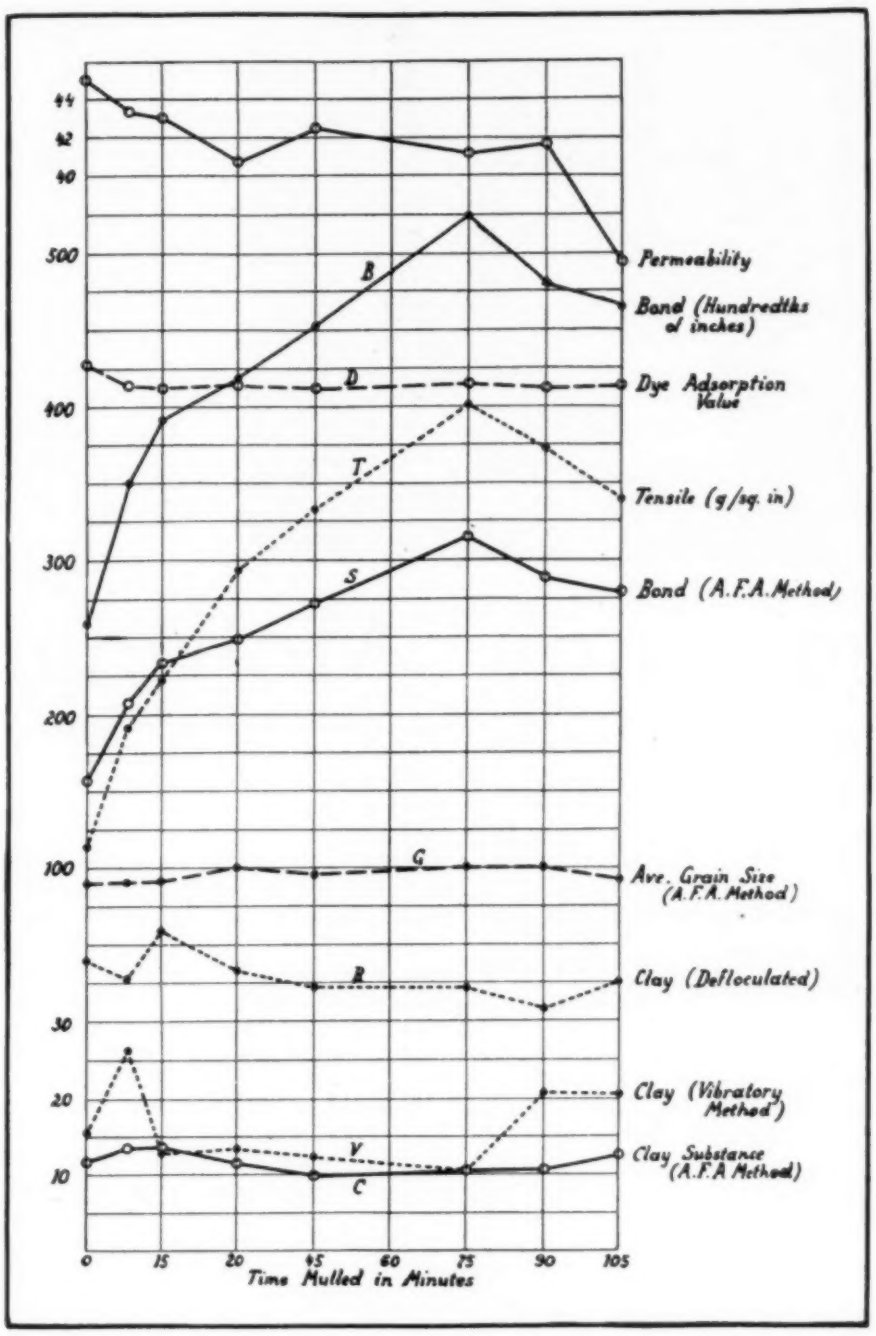


FIG. 3—EFFECT OF MULLING ON THE PHYSICAL CHARACTERISTICS OF NEW SAND MIXTURE NO. 5

apparatus in a room adjacent to the foundry. Each sand heap is tested for bond and permeability and appropriate additions are made at least once a week, sometimes two or three times, depending on the individual jobs. Heavily cored jobs frequently require daily attention.

The test apparatus consists of the standard A. F. A. permeability testing outfit, fitted with a direct reading scale for use with the standard orifices, the tensile bond measuring device descrbed previously and a moisture measuring apparatus.

An important factor in foundry control work is the system for determining and recording losses. Each molder's castings are kept separate until they have been cut from the gates, cleaned and inspected. Molding losses due to dirt and shifts are charged against the molder's piece rate wage. The instructors may earn a weekly bonus by cutting down on these losses. The daily loss of each molder is reported back to the instructor and charts showing the loss of the group under each instructor are posted. The faulty work produced on each molding floor is coordinated with the physical characteristics of the heaps and the additions of the sand as an aid to the man handling the sand.

The results of a year of control work, the last ten months of which recovered sand was used in considerable quantities on all the brass molding floors, have been gratifying. The reclamation work alone has made no great saving because our consumption of sand is not large. However, it has covered the expense involved in reclamation and control work, giving the benefits in the way of reduced losses as clear gain.

During the years 1922 and 1923 the cost of the new molding sand used in our brass foundry was slightly over $1.00 for each ton of good castings produced. This was due to the fact that we were using only high grade eastern sands and paying high freight rates. During the past six months this item has averaged only $0.46 per ton of castings, a reduction of 54 per cent.

Reduction in Foundry Losses

The reduction in foundry losses during the past year has been worth more than the saving in sand. During 1922 our brass foundry loss was 8.5 per cent. It averaged 9 per cent for the first three-quarters of 1923. Since that period there has been a marked reduction, the average loss for the past five months being less than 4 per cent. Dirty castings were reduced 60 per cent and blows and misruns 55 per cent. Translated into dollars and cents this means a saving of $2,000 to $3,000 per month.

Of course, this saving is not due to molding sand alone. We would certainly not ascribe it to the use of recovered refuse sand. The personal factor is an important element in molding and due credit must be given to the molders and their instructors. The system of recording losses and placing responsibilty for them has been a big factor. The sand control work which has been carried along with the reclamation work, has been a most important factor in two respects: It has helped to keep the sand heaps in good condition and so permit the molder to get better results; and it is giving definite knowledge about the condition of the sand so that the sand is no longer *the goat* for every trouble the molder may have, the cause of which is not always readily apparent.

Advise Shop Inventory

In a clients service bulletin published by the American Appraisal Co., Milwaukee the readers attention is called to the value of an appraisal at the time of a fire. Its possession is the best possible assurance that an equitable adjustment will be made. Where the appraisal is recent it will furnish all the data necessary for preparing a full proof of loss. Where some little time has elapsed between the dates of the appraisal and the date of the fire it probably will be necessary to make some adjustment for alterations in values and for actual changes in the properties.

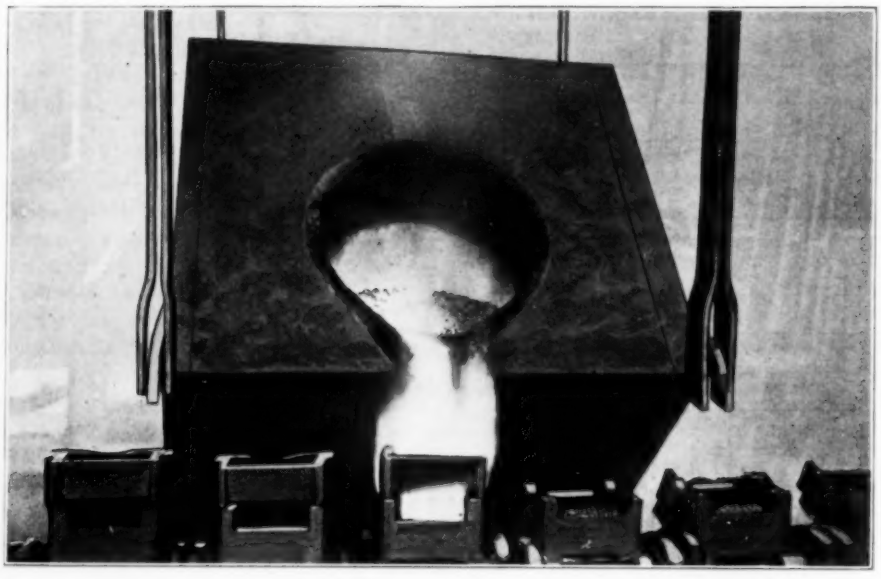


Fig. 1—When Melting Is Completed, the Furnace May Be Lifted and Poured Directly

A Charge of 600 Pounds of Copper Has Been Melted in the Crucible Under Charcoal

High Frequency Melting

Induction Furnace Developed to Meet Special Problems

By Dudley Willcox
Ajax Electrothermic Corp., Trenton, N. J.

HIGH frequency currents have been applied to melting and heat treating operations on a laboratory scale for seven or eight years. Commercial installations have been made for producing alloys of nickel-iron, gold-platinum, osmium-iridium and other metals which require high temperatures, freedom from contamination and thorough mixing. High frequency furnaces also are used commercially for melting metals of the tungsten group in graphite containers for producing carbides.

The principle of these furnaces is that of a transformer in which the primary is a coil of copper conductor and the secondary is a mass of conducting material within the coil. The high frequency furnace may have a bath in the form of a cylinder which has small radiating surface for a given volume. The metal bath may be contained in an ordinary crucible. The current does not heat the coil much above room temperature, but the mass within the coil is rapidly heated to the melting point and higher, if desired. The metal is stirred by electro-magnetic forces assuming thorough mixing of alloys.

The usual form of high frequency current converter consists of a reactance, a step-up transformer, a special form of discharge gap, and a bank of condensers. Current from 60 cycle power lines is changed to oscillatory current having a frequency which is the natural period of the furnace circuit.

Fig. 2 shows a high frequency furnace operated from a rotary high frequency generator. Fig. 3 shows the generator driven by a steam turbine operating with 10 pounds steam pressure. A bank of condensers show at the right of Fig. 3 serves to correct the power factor of the furnace circuit. In place of the steam turbine an oversize synchronous motor to drive the generator may be used to correct the power factor of the primary power supply lines.

The furnace illustrated has been used for melting nickel-silver and copper, and the stirring effect is pronounced as in the case of small furnaces operated with oscillatory current. About 600 pounds of copper can be melted in a little over an hour with a power input of about 100 kilowatts.

Fig. 1 shows the furnace containing

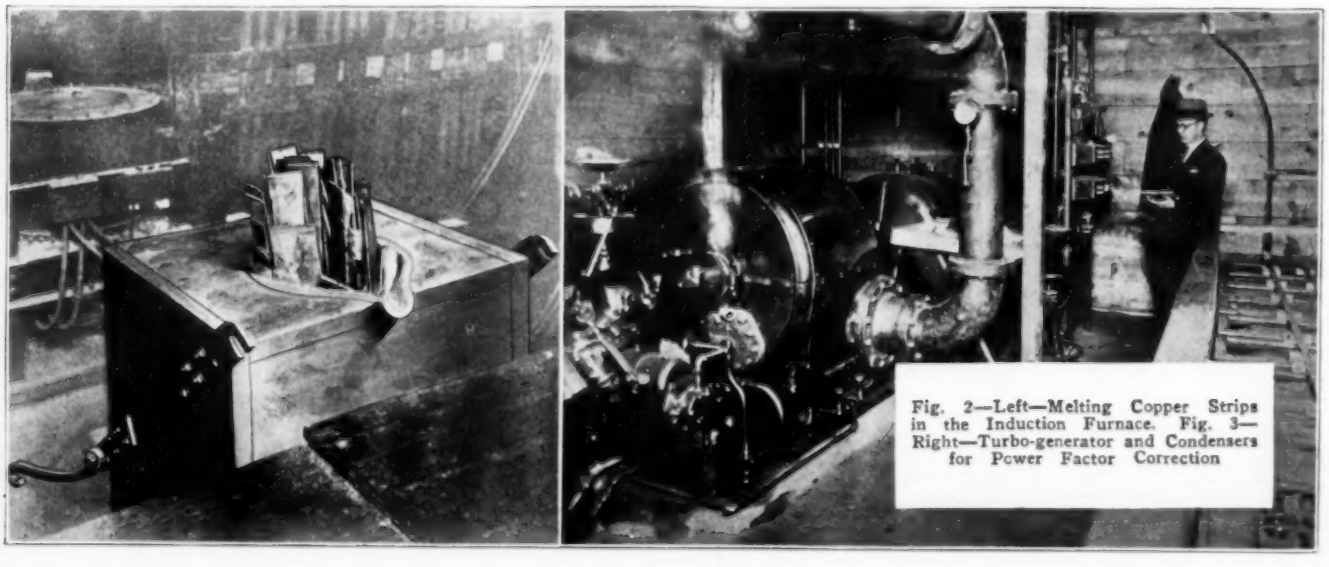


Fig. 2—Left—Melting Copper Strips in the Induction Furnace. Fig. 3—Right—Turbo-generator and Condensers for Power Factor Correction

Comparative Data on High Frequency Melting

Crucible	Metal	Pounds	Kilowatt rate	Time of melting hour	minutes	Total KW-H. consumed	Lbs. per KW-H.
Cold	Nickel-Silver	636	90.1	1	49	163.8	3.98
Hot	Nickel-Silver	636	92.8	1	18.6	121.8	5.23
Cold	Common Brass	636	99	1	04	105.5	6.02
Hot	Common Brass	636	99.5	..	43	71.3	8.9
Hot	Copper	636	100	1	09	115	5.53
Cold*	Nickel-Silver	600	84.9	1	22	115.70	5.19

*(Data on last line taken by E. F. Northrup. Metal in solid lump at start).

molten copper being poured into a series of iron molds. The power can be applied during pouring if necessary to keep the contents at the proper pouring temperature. The heat shown was melted under a covering of charcoal.

The data shown in the accompanying table are interesting as comparisons of the efficiency of the furnace in melting different materials and different forms of material. In the first four cases the material was charged in the form of scrap pressed into *cabbages* and some loose scrap. The fifth melt recorded consisted only of copper strips as illustrated in Fig. 2. The sixth melt was of a solid lump of nickel-silver which had been allowed to freeze in the crucible over night. It will be noted that the efficiency in this last case was somewhat better than when cabbaged nickel-silver was melted as recorded in the first line of the tabulation. A molten mass may solidify in the crucible and be re-melted without cracking or injuring the crucible.

Melt Iron Alloys

Another intersting high frequency furnace installation was made recently at the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This company is melting nickel-iron and silicon-iron alloys in 225 pound lots—operating the furnaces from a 5000 cycle generator, driven by a direct current motor. The generator is rated at 100 kilowatts and practically the full power is delivered to the furnace circuit. A melt takes less than an hour. The necessity for keeping the carbon content of their alloys to the astonishingly low figure of 0.006 per cent or less makes it necessary to use a non-carbonaceous crucible. The Zicon crucibles used, last only for one heat, but the cost of melting is nevertheless considered low. Some of the melting is done under a vacuum and some under hydrogen.

An etched section of an ingot of nickel-iron alloy weighing 225 pounds is shown in Fig. 4. Not the least interesting feature of the production is that the ingots are not cropped. It will be observed that the ingot has a flat top. While there are a few shrinkage holes near the top they are found to weld on forging and the entire ingot is rolled.

All of the furnaces described were made under direction of the inventor, Dr. E. F. Northrup of Princeton, N. J.

Blowholes in Rim Caused By Steel Spokes

Question: We are having trouble with blowholes in sheave wheel rims opposite the ends of steel spokes. The ends of the spokes are ground clean and several small holes are drilled in each before the spoke is placed in the mold. The ends are painted with red lead mixed with benzine and well dried. The mold is made by assembling a number of dry sand cores and the rods must be placed in position at the beginning of the assembly. The mold is not poured until about 6 hours later. Please advise how to treat the ends of the spokes to secure solid castings.

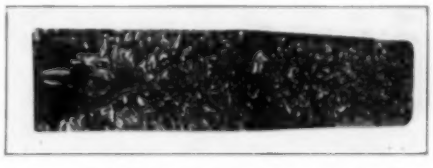


FIG. 4—ETCHED SECTION OF 225 POUND INGOT OF NICKEL-IRON ALLOY MADE IN A HIGH FREQUENCY FURNACE

Answer: Blowholes in castings in the vicinity of steel or iron inserts are caused either by water or rust or in extreme cases by both and therefore the character of the material employed as a protective coating may vary to a considerable extent. If the end of the exposed rod is perfectly clean and dry it requires no coating of any kind, but since this condition practically is impossible to obtain under ordinary foundry conditions, a protective coating of some kind is applied as a precautionary measure. The list of materials employed for the purpose includes coal oil, machine oil, chalk, tar, shellac, red lead mixed either with linseed oil, gasoline or benzine, and sodium silicate, better known as water glass. The ends of the spokes are prepared either by grinding or by heating them to a red heat to burn off any adhering rust or scale.

Since your rods are cleaned and coated it is apparent that your trouble is not due to rust and therefore we are forced to the conclusion that they become damp. Sometimes cores are not thoroughly dried and will *sweat* when assembled in a cold mold. Sometimes the cores are properly dried, but later while cold are surrounded by warm or steaming sand. The moisture condenses on the face of the cores and also on the ends of the rods, irrespective of whether or not they are coated. Clean the ends of the spokes, coat them with water glass, warm the ends and assemble the mold in cold sand.

Administration Board Holds Meeting

The quarterly meeting of the board of administration of the Ohio State Foundrymen's association was held at the Hotel Gibson, Cincinnati, Jan. 15. Cost work, an activity of the association since its inception, was discussed and an effort will be made to form additional groups in various centers for the study of costs. This work will be under the direction of E. T. Runge, Runge Cost Co., Cleveland.

The subject of simplified practice, which was called to the attention of the association in an address by R. M. Hudson, department of commerce, Washington, at the annual convention held in Cleveland in 1924, was discussed. It was decided that while there was a broad field for work in this direction, the matter could be handled properly through the American Foundrymen's association, and that the Ohio State Foundrymen's association would be willing to co-operate in any way to bring about the desired results.

The insurance situation was discussed at length and it was agreed that many members are not giving this matter the proper attention. This covers all forms of insurance, including fire, liability, etc. It was suggested that the subject be investigated and the possibility of working with some reliable insurance agency and inspection bureau be given attention. It was pointed out that this also would broaden safety work in the plants of the members, thus reducing accidents and the workmen's compensation insurance rates, as required by the Ohio law.

Joins Robert June, Inc.

C. B. Starr has joined Robert June, Inc., 8835 Linwood avenue, Detroit. Mr. Starr was graduated from Cornell university in mechanical engineering. He was assistant mechanical engineer with the Duff Manufacturing Co., Pittsburgh, and later served in the capacity of sales engineer with the Detroit office of the Wayne Tank and Pump Co.

Patternmaker Uses Chisel Constantly

BY WALTER C. EWALT

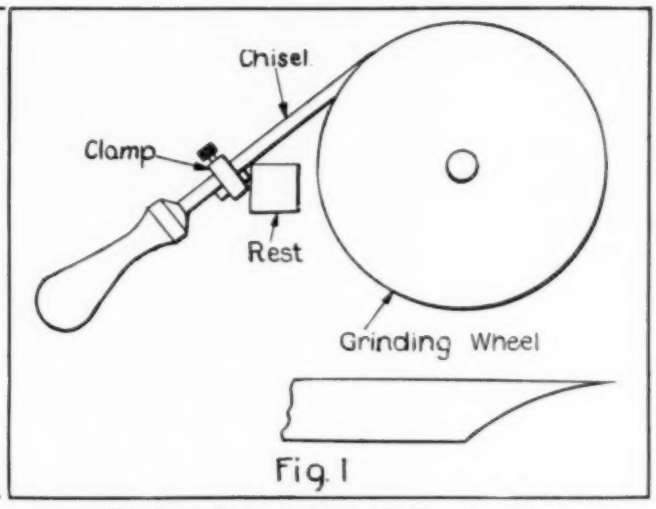


Fig. 1—A Clamp Assists in Holding the Chisel

WHEN man first made tools to fashion timber, he probably made a wedge of wood or stone to split apart fallen trees. Modern cutting tools as well as many other mechanical devices have been developed from the shape and form of the wedge. However, the wedge merely divided the wood in the direction of the grain, and therefore left a rough surface. This led to the invention of a tool which not only would split, but would cut the wood along fixed lines. This probably was accomplished by grinding the edges of hard wood, then stone, bronze, iron and at last steel. The tool of this description used today is called a chisel.

If a blunt chisel acting as a wedge is driven into the end of the piece of wood, the cutting is limited to a small amount, and as the chisel is driven further into the wood, the split precedes the chisel, following the path of least resistance or the direction of the grain. The chisel may be directed in a definite line until the wedge shape prevents the edge of the chisel from cutting by forcing the wood apart and opening a slit in front of the cutting edge. From this it may be seen that the small cuts must be taken near the surface of the wood if the chisel is to be used properly. This action involves both cutting and wedging since, when the chisel is working forward, the wedge shape of the tool causes the shavings to curl or bend up out of the way. The edge of the chisel always must be in contact with the wood, or the tool works only as a wedge. When the chisel is ground to a small taper the wood is cut much more easily, but if ground in this manner the tool will not stand up, or will not be strong enough to force or bend the shavings up out of the way, thus causing the cutting edge to break.

It may be noticed that the chisel differs from the wedge by being ground on one side only, the back being kept perfectly straight and flat. The flat side must be kept straight and never ground since it acts as a guide in cutting straight to the line. Particular care should be taken in grinding chisels on a grinding wheel not to burn or destroy the edge. Frequent dipping in water is necessary to keep the edge cool and the chisel should be held lightly against the stone in the finishing grinding operation. Care should be taken to avoid an excess formation of a feather edge. The angle to which the chisel is ground depends on the type of tool, that is whether parting or firmer, whether hard or soft wood is to be worked and also on the strength of the steel.

The parting chisel, which is used only by hand, is somewhat thinner than firmer chisels and a more acute angle may be given it. The firmer chisel, which is driven by a mallet, must be thicker and the angle larger to withstand the heavy blows. The same thing applies to chiseling hard or soft woods, the softer the wood the smaller the angle. The main difference between the parting and firmer chisels is in the shape of the handles and length of blades, the firmer being shorter. Worn down parting chisels may be used as firmer chisels. The angle to be ground varies from 20 to 30 degrees, depending on the conditions just discussed.

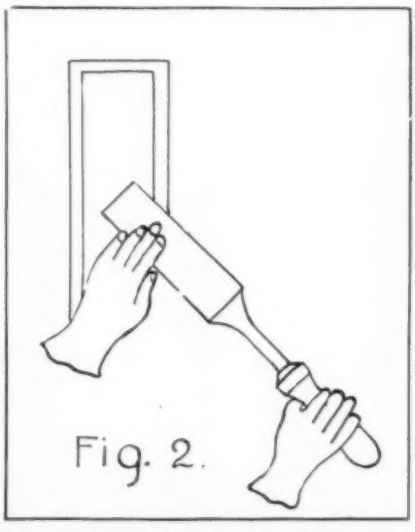


FIG. 2—ROCKING MAY BE PREVENTED BY HOLDING THE CHISEL DIAGONALLY

It appears that chisels are easier to guide and easier to wet on an oil stone if they are hollow ground. This may be accomplished by holding the chisel in the same angle on the stone and moving the chisel from side to side. A piece of iron may be clamped to the face as shown in Fig. 1 to facilitate placing the chisel back in the same place each time after dipping it in water to cool. As the grinding leaves a rough wire edge, it is necessary to whet the chisel on an oil stone to obtain a fine cutting edge.

It is here that the advantage of having the chisel hollow ground may be seen, since it is much easier to sharpen it to the same angle as ground. One is more likely to whet to a greater angle if it is ground straight instead of hollow since a few strokes across the oil stone will sharpen it at the angle wanted if hollow ground, while it takes far more whetting to wear away the full length of a straight ground angle.

In whetting, the oil stone being flat, straight and in good condition, is given plenty of oil. The heel of the angle is first placed on the stone and the handle is raised until the heel and edge lie flat on the stone. This may be seen by the action of the oil at the edge of the chisel as it exudes from under the edge of chisel when it is raised. When the position of the tool on the stone is fixed, the chisel should be moved back and forth across the length of the stone, care being taken that the chisel does not rock. The rocking may be prevented largely by holding the chisel on the stone diagonally as shown in Fig. 2. This position allows a natural movement of the elbows when moving them back and forth, clearing the body and keeping the edge from being spoiled by rocking.

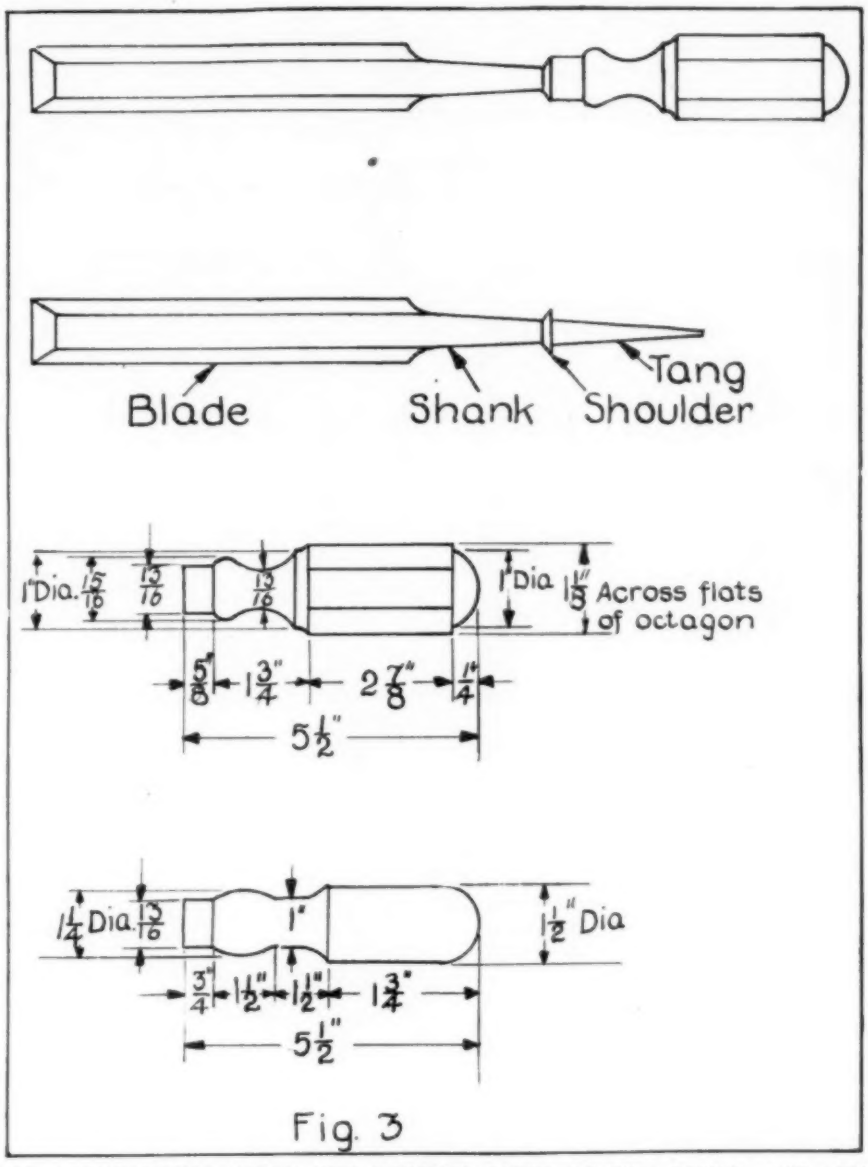


FIG. 3—THE NAMES GIVEN THE VARIOUS PARTS OF THE CHISEL AND THE DIMENSIONS OF A WELL PROPORTIONED TOOL ARE GIVEN

After a few strokes the chisel should be examined for the wire edge, which is turned over by whetting, by feeling across the flat side with the thumb. The chisel has been whetted enough when this wire edge is felt. The edge is removed by turning the chisel over on the flat side and moving it across the stone while held perfectly flat. The chisel then is reversed to the original position and a few strokes made in that way. This may be repeated several times, the edge then being lapped upon the band or stropped on a piece of leather. Some test the sharpness of the edge by feeling it with the thumb while others see if it is sharp by holding up to the light. The chisel with a beveled edge is preferred as it looks neater, is lighter and may be used in corners and angles where it is impossible to use the square edge tools. The chisel with the bent shank shown in Figs. 5 and 6, will be found more useful than if straight.

The names of the various parts of the chisel and the dimensions of a well proportioned tool are given in Fig. 3. The chisel is used in four different ways, namely for chopping, paring, cutting across grain and end grain. In chopping, the chisel is held around the shank and blade and is used as a hatchet. The patternmaker has little chopping to do. The paring, cross grain and end grain operations may be illustrated by making a mortise where the bottom of the mortice is pared, cross grain is cut on the sides and end grain at each end of the mortise, as shown in Fig. 4. Paring usually is accomplished by cutting the wood with the grain and holding the flat side against the wood, the angle of the chisel making the chip curl up out of the way, as shown in Fig. 5. The paring done on the mortise shown in Fig. 4 is accomplished by holding the chisel as in Fig. 6.

Cross grain chiseling is done as far as possible by advancing one corner of the chisel ahead of the other so that the chisel will be at an angle to the wood and giving it a shearing or sliding cut, somewhat similar to whittling a stick with a knife. This method leaves a smoother surface than if cut straight across. The chisel pushes much easier because the angle of the bevel is less, the same texture of grain is not cut at the same time as would be the case if the grain laid in the same line as the cutting edge, and like a saw or even a razor, the chisel has a series of fine teeth which cleaves the fibers in the same manner as a saw.

Only thin cuts should be taken in cutting end grain or the strain will be too severe on the edge of the chisel. If a chisel having a blunter edge is used, it has a tendency to chew off the wood, which breaks the grain off beyond the line. Often the line is drawn on the wood, the chisel is used to take a cut ⅛ to ¼-inch in width and 1/16-inch in depth. This is continued across the end and about one-half the length of the full cut. The wood then is reversed and the cutting is made the same way. This is done to prevent breaking the edge of

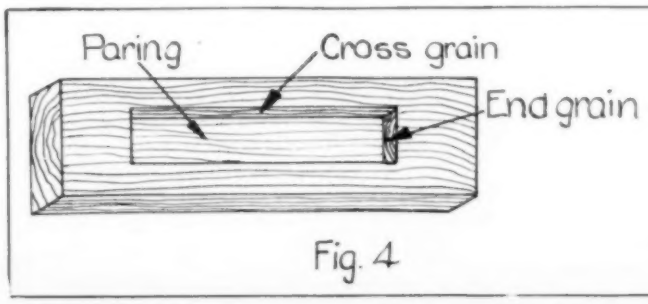


FIG. 4—PARING, CROSS GRAIN AND END GRAIN OPERATIONS ARE EMPLOYED IN MAKING A MORTISE

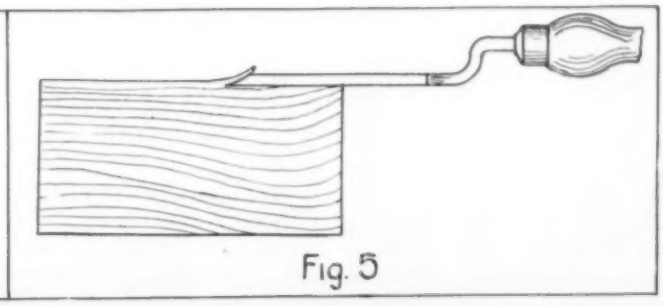


FIG. 5—THE ANGLE OF THE CHISEL MAKES THE CHIP CURL UP OUT OF THE WAY

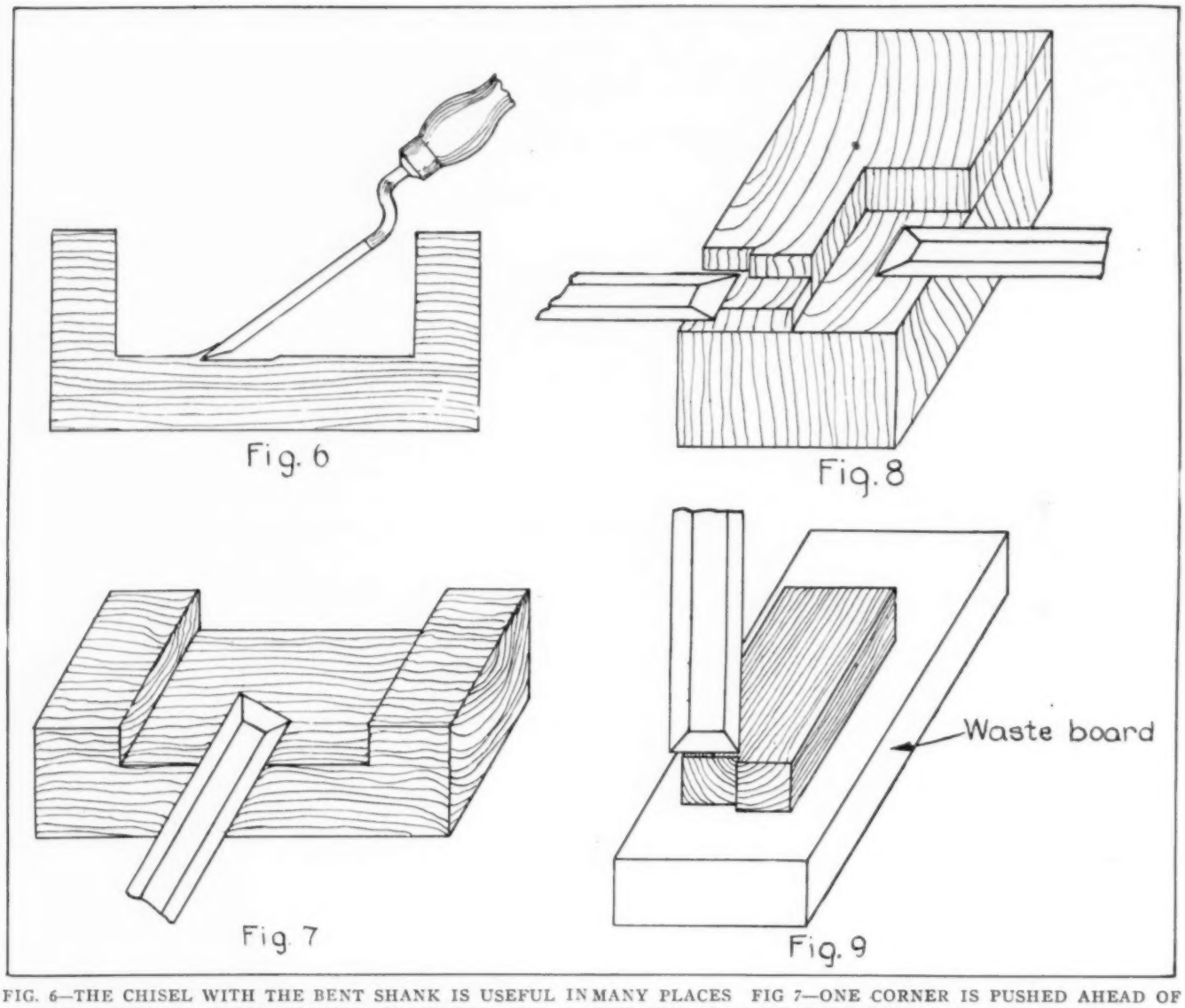


FIG. 6—THE CHISEL WITH THE BENT SHANK IS USEFUL IN MANY PLACES FIG 7—ONE CORNER IS PUSHED AHEAD OF THE OTHER IN CROSS GRAINED CHISELING FIG. 8—THE CUT IS MADE HALF WAY AND THE BLOCK REVERSED TO MAKE THE CUTTING EASIER FIG. 9—A PIECE OF SCRAP WOOD CLAMPED TO THE PIECE BEING CHISELED ALLOWS THE WOOD TO BE CUT CLEAR ACROSS

the wood on the outside. This method of cutting may be noted in Fig. 8. If the surface is such that a waste board may be clamped to the back and a tight joint made at the cutting edge, it acts as a support for the fibers underneath and the cut may be made clear across, as shown in Fig. 9.

When making a mortise for a dowel plate, some workmen, after marking the outline with a scriber or knife, cut the outline fairly deep with a knife before starting to chisel. Others start the chisel about ¼ inches away from the line and work back to the line with a series of small cuts until the line is reached.

Desulphurizing Coke

Experimental work on a laboratory scale on the desulphurization of coke by steam, conducted by the bureau of mines in co-operation with the Carnegie Institute of Technology at the Pittsburgh experiment station, has demonstrated that steaming process is successful. These experiments indicate future utilization of enormous reserves of high sulphur coals that now are unsuitable for coke making. At present only low sulphur coals are used for such purposes.

New England Foundrymen Elect Officers

At the annual meeting of the New England Foundrymen's association held at the Exchange Club, Boston, Wednesday, Jan. 14, 1925, R. F. Harrington, metallurgist of the Hunt-Spiller Mfg. Corp., Boston, was elected president to succeed Norman Russell, vice president of Albert Russell & Sons Co., Newburyport, Mass.

Other officers elected were vice president, H. P. Blumenauer, Arcade Malleable Iron Co., Worcester, Mass.; treasurer, George H. Gibby, Gibby Foundry Co., East Boston; secretary, Fred F. Stockwell, Barbour-Stockwell Co., Cambridge, Mass.

The new executive committee consists of H. S. Chaffee, Builders Iron Foundry, Providence, R. I., Thomas E. Officer, Sullivan Machinery Co., Claremont, N. H., Carl H. Neunan, Union Mfg. Co., New Britain, Conn., Thomas I. Curtin, Waltham Foundry Co., Waltham, Mass., and C. A. Reed Fears & Miller, Boston.

Professor G. W. Dyer of Vanderbilt University, Nashville, Tenn., addressed the gathering on the subject of economics, leadership, and foundries. Nearly 300 members attended the meeting which marked the 29th anniversary of the association.

The Presque Isle Foundry, Presque Isle, Me., has been incorporated for $50,000. Samuel M. Tuck is the president of the new company.

Milestones in Foundry Progress

As Recorded in the February Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago

SIMPSON BOLLAND, one of the first, if not the original teacher of foundry methods thorugh the printed word was the guest of honor and speaker at a meeting of the Philadelphia Foundrymen's association held Jan. 2, 1895. In describing the *cire perdu,* or lost wax process of molding, he said the ancients really secured a refractory surface in their molds from the carbon in the melted wax.

* * *

How much can moderns claim for originality in carbon coatings applied to permanent or long life molds?

* * *

The state prison foundry in Texas was occasioning discussion. Indignation meetings were held in various cities in the state, and foundrymen resented not only the competition of prison labor, but discriminatory freight rates granted the state prison foundry by the railroads.

* * *

A benevolent and charitable, mutual admiration society, christened the Plumbago Club, took life among the rustling palms of that oasis known as Shuler's on Vine street, Cincinnati. Five weary travelers, John Hill, J. S. Hibbs, J. D. Smith, T. L. Griffith and H. F. Frohman, who met there to remove the dry, dust of desert foundry sands conceived the idea.

* * *

From this chance contact came an organization of good fellows famous for the following twenty years. Of such is the salt of the earth.

* * *

No. 2 foundry iron was selling at $10.00 to $10.25 cash, Pittsburgh.

* * *

The Penn Steel Casting Co., Chester, Pa., completed 93 gun carriage castings on which the average of 106 test bars showed a tensile strength of 74,500 pounds per square inch with 21.6 per cent elongation and 26.6 per cent reduction in area.

* * *

William P. Darling, manager, of the Lynn, Mass., plant of the General Electric Co., reported an average production of 650,000 pounds of finished steel castings per month for the preceding six months.

Faked Foundry Facts

Mud

IN A description of the plant of the Dickson Mfg. Co., Scranton, Pa., purchased by the Allis-Chalmers Co., appearing in the issue of February, 1905, reference is made to the "scratch house." This term reflects the prevalent use of wire brushes for cleaning castings in those days.

* * *

Scratch house was a term of much deeper meaning, and of greater personal interest to the boys of the A. E. F., twelve years later. Ever read a shirt?

* * *

R. W. M'Dowell described in detail cost finding methods in a radiator shop.

* * *

A report of the Pittsburgh Foundrymen's association meeting contained quotations from such veterans as S. D. Sleeth, Westinghouse Air Brake Co., W. H. McFadden, Mackintosh, Hemphill & Co., B. D. Fuller, Westinghouse Electric & Mfg. Co. and A. W. Slocum, National Car Wheel Co.

The Singer Mfg. Co. acquired the land and buildings formerly occupied by the Worthington Pump Works, Elizabeth, N. J.

* * *

The Ellis Foundry Co., South Carver, Mass., closed its hollow ware shop. This plant originally was an early blast furnace property making iron from bog ore. Later it operated a cupola. The Murdock family were the original owners and during its existence the shop had made projectiles for the Revolutionary, 1812 and Civil wars.

* * *

The plant of the American Steel Foundries, Chester, Pa., was molding 20 large castings, each requiring 120,000 pounds of steel. These were for the new Brooklyn bridge in New York.

* * *

What constitutes the record weight for a steel casting? What was the largest ever made?

* * *

A boomer patternmaker from Pittsburgh was given a job in a St. Louis shop where he was temporarily employed. This patternmaker had never seen shrink rules such as were in use in this western foundry, so he added a substantial shrinkage to all measurements not knowing that this already was provided. When the machine shop foreman arrived some days later with blood in his eye and assailed the Pittsburgh patternmaker with vigorous speech, you know the kind, the latter said, "To take id off is a dom sight easier, yet, dan to pud id on again, aind't id?" Thus originated the expression, Pittsburgh Plus.

* * *

The Allyne Brass Co., Cleveland, had incorporated in Michigan to open a branch in Detroit.

THE various state laws pertaining to dust removal were reviewed in the leading article of the February, 1915 issue of THE FOUNDRY. An article on a practical first aid kit also reflected the study devoted at that time to human conservation and safety questions.

* * *

The Sivyer Steel Castings Co., Milaukee, inaugurated a training plan to teach its molders steel foundry

(*Concluded on Page* 130)

The Shakeout

A. O. BACKERT, Editor

DAN M. AVEY, Managing Editor
PAT DWYER, Engineering Editor
CHARLES VICKERS, Nonferrous Editor
GEORGE A. DRYSDALE, Metallurgical Editor
FRANK G. STEINEBACH, Associate Editor

¶ He Who Gets Squeezed

WITH all this genial warmth of prosperous times dawning in early 1925, a little cloud on the industrial horizon threatens showers if not high winds and a destructive storm for foundrymen. No one can fail to notice the lower prices on finished commodities. This year's automobile shows impress upon the mind of the prospective buyer that any sort of a car from the oil-cloth lined Rattler to the sumptuous, plush upholstered Ritzomobile cost less than ever before. Price a dining room suite of funiture, a gas stove or a bathtub, and the the salesman will tell how much less these articles cost today compared with one or more years ago. Reduction in price is the order in finished commodities.

TURN the attention then to the market prices on raw materials which the foundrymen must purchase. Pig iron coke and nonferrous metals have shown no signs of reduction. Labor costs as much as before. With business improving and greater demand, prices are not likely to be lower in any of these fundamental items that make costs in foundry operation.

Consider the resulting pressure and where it will be exerted. The buyer of castings, particularly if he sells to the ultimate consumer is going to ask and expect lower prices from the foundry. Yet, the foundryman cannot pass along these reductions to the items of production; at least at present. The moral is obvious:

Refrain from Price Cutting Until Production Costs Are Lower

¶ Furnaces Eat the Bricks

GRAY iron foundrymen with their limited consumption of fire brick have little conception of the immense volume of this commodity used in other branches of the industry. The main lining in a cupola stack will last for years. A limited area at the melting zone is replaced at periods ranging from a month to a year depending on the skill of the melter and to a greater extent on the length of time the cupola is in blast each heat. Naturally, the lining will last longer in a cupola running one or two short heats a week than it will in one where the heat runs continuously all day every working day in the week.

OPEN-hearth, steel, melting furnaces and malleable iron melting furnaces are the real gluttons for fire brick in the melting field. A 25-ton open-hearth steel furnace with its ports and checker chambers requires more brick in its construction than a dozen cupolas of an equal daily melting capacity. General repairs over a 3-month period will consume more brick than a cupola running for 50 years. Cages, doors, ports and checker chambers have to be replaced at frequent intervals. If a melter gets 100 heats off one roof he is not dissatisfied. A roof that lasts for 200 heats is considered a cause for congratulation and if it serves for 300 heats before it collapses the melter feels he is entitled to a medal.

MALLEABLE iron furnaces running two heats a day are practically rebuilt every week and roof bungs are replaced daily. The 6000 or more cupolas in the United States and Canada consume a considerable volume of fire brick, but the fire brick manufacturer's greatest market is in the steel melting and malleable iron melting field.

¶ Resents Role of Goat

UNDER legitimate emergency conditions foundrymen are ready and willing to co-operate with customers in pushing rush orders of castings through their shops, even though this action on their part interferes with the regular program and increases operating costs to some extent. Occasionally, the customer recognizes and admits this point, in rare cases going so far as to suggest his willingness to consider a claim for extra compensation. This kind of service is an accommodation or a privilege and naturally the foundryman resents any abuse of it. His temper and his degree of respect for the customer are not increased when he is asked to rush a lot of castings through his shop, particularly when he learns later that the job was held in abeyance on half a dozen occasions waiting the approval of professional, procrastinating officials.

HIS exasperation is not reduced to any extent later when he discovers the castings reposing peacefully in the customer's yard or store room where they have been delivered in a hurry long before they are needed.

Customers who adopt hog tactics in getting their castings through a foundry, with a total disregard of the rights of other customers who place their orders in advance, are just as popular among foundrymen as their first cousins who hold the middle of the road are popular among drivers.

Trade Outlook in the Foundry Industry

NO MARKED acceleration is noted in orders received by foundries, although the momentum of the pickup early in November seems to have carried through until the present. Further, a hopeful attitude is prevalent, evidenced by statements of foundrymen, as well as by their inquiry for new equipment which will be needed when business becomes more brisk and by their purchases of pig iron. However, delivery on pig iron contracts is being held back, as none wishes to accumulate a heavy yard stock, with the market uncertain and the immediate demand for metal not pressing. First quarter iron in many cases will carry through the half year.

Building Looks Bright

Building contracts awarded in 27 northwestern states in December, according to the department of commerce, totaled $283,091,000 against $341,344,000 in the preceding month, but showing an increase over the total of $267,961,000 in December, 1923. This gives a general indication of the state of business and prospects for 1925. During the past few years, the great volume of building construction has centered in the larger cities. Apartment house construction has gone forward with immense strides during the closing months of 1924. This always is the case when interest rates are low. With increased business in many lines and a rise in interest rates which is anticipated, this trend probably will switch. At the same time, some of the depressing elements which have actuated manufacturing concerns in delaying expansions may be removed. Further, with bettering conditions in rural centers, greater activity is expected in building lines in smaller communities during 1925. *The Architectural Forum* in its annual survey and forecast states that 1924 was a 5½ billion dollar year in construction lines and 1925 is expected also to approach five billions.

Prices for Raw Materials for Foundry Use

CORRECTED TO JAN 22

Iron		Scrap	
No. 2 foundry, Valley	$22.50 to 23.00	Heavy melting steel, Valley	$22.00 to 22.50
No. 2 southern, Birmingham	21.50 to 22.00	Heavy melting steel, Pitts.	22.00 to 22.50
No. 2 foundry, Chicago	24.00	Heavy melting steel, Chicago	19.50 to 20.00
No. 2 foundry, Philadelphia	24.76 to 25.26	Stove plate, Chicago	18.00 to 18.50
No. 2 foundry, Buffalo	23.00	No. 1 cast, Chicago	21.50 to 22.00
Basic, Valley	22.00 to 23.00	No. 1 cast, Philadelphia	20.50 to 21.00
Basic, Buffalo	22.50 to 23.00	No. 1 cast, Birmingham	17.00 to 17.50
Malleable, Chicago	24.00	No. 1 cast, Buffalo	18.25 to 18.75
Malleable, Buffalo	23.00	Car wheels, iron, Pittsburgh	21.00 to 21.50
Coke		Car wheels, iron, Chicago	21.00 to 21.50
Connellsville foundry, coke	$4.50 to 5.00	Railroad malleable, Chicago	22.50 to 23.00
Wise County foundry, coke	5.00 to 5.50	Agricultural, mal., Chicago	22.00 to 22.50
		Malleable, Buffalo	20.00 to 21.00

Demand Conveniences

One factor in building construction and in renovating existing structures that is having an immediate effect on the sale of certain classes of castings is the higher standard of living acquired by the American public. Indoor water systems, bath facilities and electrical conveniences are demanded particularly in renting property, wherever located. Mail order houses note that increased sales are being made in gasoline engines for farm power purposes, in furnaces and bath room appliances. Orders for sanitary ware showed a marked increase in December, according to the department of commerce. The total of bath tub orders received in December was 109,263 compared with 77,068 for November and 77,361 for October. Further, unfilled orders showed an increase for the first time since last April. The orders received for lavatories and sinks during December showed even more of a stimulus. The unfilled orders on all classes of small ware increased from 174,127 in November to 254,625 in December.

Steel Shops Pick Up

Orders for steel castings took a decided brace in December, according to the department of commerce. The total net tons booked in December was 96,164 compared with 74,220 tons in the preceding month. This represents 95.8 per cent of capacity for December compared with 73.9 per cent of capacity in November, basing the computation on the reports of 70 identical companies. The ratio of net tons booked during the month of December to the total estimated capacity is the largest since March, 1924. This ratio decreased from March until August and then started to advance. The class of demand which has contributed most strongly to this improvement in steel foundry operation is railway purchases. The orders for rail steel specialties during December totaled 124 per cent of the capacity of the plants listed. The improvement in railway steel castings purchases has dominated the steel castings field and the ratios of orders booked to capacity has fluctuated, starting with March as a high point and decreasing to August and again swinging upward to the high total in December. The miscellaneous steel castings booked during December represented 74.6 per cent of capacity compared with 57.3 per cent for the preceding month. Orders for malleable castings, similarly, showed an increase in December. Railway car purchases still are active. A total of 18,475 freight cars were ordered during December, compared with 12,720 for the preceding month. Inquiries are heavy, particularly from the western roads. The growing financial strength of the railway lines, a confidence in freedom from government interference and the trend toward consolidation point to a bright year for manufacturers of railway equipment of all classes. Unfilled orders for locomotives showed an increase from 397 in November to 431 in December. Orders received by the General Electric Co. for the three months ending Dec. 31 increased 7 per cent over the same period for 1923. However, the business placed during the entire year, 1924, fell below the preceding year by about 7 per cent. Increased refractory business gives an indication of foundry activity.

Nonferrous Prices

New York prices on nonferrous metals, according to the *Daily Metal Trade* of Jan. 22, follow: Casting copper, 14.25c to 14.37½c; electrolytic copper, 14.70c to 14.75c; Straits tin, 55.87½c; lead, 10.00c to 10.25c; antimony, 16.87½c; nickel, 38.00c; No. 12 aluminum, remelt, 22.50c to 23.00c. Zinc is 7.65c, E. St. Louis, Ill.

Comings and Goings of Foundrymen

GEORGE E. DOKE, engineer of tests for the New York Central railroad New York, has been elected president and treasurer of the Association of Manufacturers of Chilled Car Wheels, with headquarters at 332 South Michigan avenue, Chicago. He succeeds George W. Lyndon, who died Oct. 7, 1924. Mr. Doke was born in Tecumseh, Mich., Aug. 19, 1877. In 1900 he entered the Elkhart Locomotive Shop, Elkhart, Ind., as an apprentice and while serving his apprenticeship he finished a special course in drawing and mechanical engineering. In 1905 he entered the physical testing laboratory of the Lake Shore and Michigan Southern railway at Cleveland as a laboratory assistant, and was made chief material inspector in 1906 which position he held up to the time of his promotion in 1912 to that of assistant engineer of tests in charge of the locomotive and car department's service tests. From 1916 to 1920, following the consolidation of the Lake Shore and Michigan Southern railway with the New York Central railroad he was assistant engineer of tests in charge of material inspection for the car and locomotive departments for the New York Central system. In July, 1920 he was promoted to the position of engineer of materials and located at Cleveland, in charge of material inspection and the development of material specifications and later in the same year he was transferred to New York in charge of the chemical and physical laboratories, the material inspection bureau and service test department. In 1922 Mr. Doke was made engineer of materials and equipment tests in charge of the service test department and his duties enlarged. He is an active member of a number of technical societies.

GEORGE E. DOKE

D. H. Slonaker, vice president, National Roll & Foundry Co., Avonmore, Pa., is about to leave on a three months' business trip to Japan.

George P. Fisher, foundry superintendent, Whiting Corp., Harvey, Ill., was elected president of the Chicago Foundrymen's club for 1925 at the annual meeting of the club, Jan. 12.

William Campbell, Howe professor of metallurgy, school of mines, Columbia university, New York, recently has been elected a member of the Institute of Metals of Great Britain.

Herman L. Green, chief metallurgist, Willys-Overland Co., Toledo, O., was elected a member of the Institute of Metals of Great Britain at the January meeting.

William Ruddy has returned from Paris, France where, during the past 18 months he has been engaged in remodeling and introducing American methods in the foundry of Andre Citroen, the largest producer of automobiles in Europe.

Louis Sacks, proprietor of the Louis Sacks Iron Foundry and the Brass Founders Supply Co., and interested in other concerns at Newark, N. J., celebrated his seventy-third birthday, Jan. 27. Mr. Sacks has been in the foundry business for many years and is one of the best known foundrymen in the East.

Gordon S. Rentschler, managing director of the Hooven, Owens, Rentschler Co., Hamilton, O., has been elected senior vice president of the National City Bank of New York. He has been a director of this institution since October, 1923. Although his new duties will require Mr. Rentschler to reside in New York the greater part of his time, he will retain his residence at Hamilton and also his connection with the Hooven, Owens, Rentschler Co. Mr. Rentschler is 40 years old and a trustee of Princeton university.

R. F. Harrington has been elected president of the New England Foundrymen's association for 1925, succeeding Norman Russell, Albert Russell & Sons Co., Newburyport, Mass. Mr. Harrington is metallurgist of the Hunt-Spiller Mfg. Corp., South Boston, with which firm he has been associated since his graduation from Tufts college 11 years ago. He is a member of and has contributed many papers to the American Foundrymen's association. His writings contribute information gained by original research at the Hunt-Spiller laboratories.

William H. Goldstine has resigned his position as foundry manager for the Nash Motors Co., Kenosha, Wis., and expects to spend the winter in Florida, enjoying a few months rest. Mr. Goldstine has been identified prominently with the automotive castings branch of the foundry industry since its early days. He served his apprenticeship with the Farrell Foundry & Machine Co., Ansonia, Conn., and later worked in a number of foundries in the east, accumulating experience. In 1900 he was placed in charge of the Norwalk Brass Co., Norwalk, Conn., which position he left a short time later to go with the Buick Motor Co., Flint, Mich., where he was superintendent of the brass and aluminum foundry. Later he was placed in control of the iron foundry of that company. In 1919, Mr. Goldstine was made manager of the new foundry of the Nash Motors Co., Kenosha, where he has been in charge until his resignation a few weeks ago.

WILLIAM H. GOLDSTINE

William H. Bassett, technical superintendent and metallurgist of the Ameri-

can Brass Co., Waterbury, Conn., has been awarded the James Douglas gold medal for 1925 of the American Institute of Mining and Metallurgical engineers for constructive research in copper and brass and other nonferrous metals and their alloys, and his contributions to the establishment of the present accepted high standard of quality. Mr. Bassett was born in New Bedford, Mass., March 7, 1868, and was graduaed in chemistry at the Massachusetts Institute of Technology in 1891. He has held important positions with the Pope's Island Mfg. Co., New Bedford, Mass., and the New Bedford Zinc Co., at Newark, N. J. In 1903 he became chief chemist and metallurgist of the American Brass Co., with headquarters at Waterbury, Conn.

Offer Changes in Scrap Specifications

A number of comparatively miner revisions in iron and steel scrap specifications prepared by the National Association of Purchasing agents were recommended Jan. 12, 1925 at a meeting at the bureau of standards Washington. One of the outstanding changes in recommendations was the adoption of a paragraph under the No. 1 heavy melting steel classification excluding alloy steel scrap from the specifications should there be mutual agreement to that effect between buyers and sellers. Another change sets up a separate paragraph covering No. 1 selected shearing scrap, which was added to the selected rail scrap specification. Changes also were made in the minimum and maximum weights and dimensions of basic, open-hearth scrap, including No. 1 and No. 2 busheling, No. 1 selected rail scrap and No. 1, No. 2 and No. 3 cast iron scrap. These revisions increase both weights and sizes in some cases. A separate class was set up for girder rails which had been included with T and guard rails. Changes to 0.50 per cent were made in the silicon content for scrap low in phosphorus and sulphur. According to the recommendations alloy steel scrap may be excluded from scrap specifications for use in electric furnaces by mutual agreement between buyers and sellers. Some changes were also made in weights in the latter classification.

The meeting was presided over by Dr. H. W. Gillett, chief of the division of metallurgy of the bureau and was attended by approximately 20 representatives of the National Association of Purchasing Agents, railroads, iron and steel works and foundries, and the federal specifications board. The recommended changes will be reported to the annual meeting of the National Association of Purchasing Agents at Milwaukee, May 25-28, 1925.

J. Herman Rodgers Dies In Pennsylvania

J. Herman Rodgers, general manager and treasurer of the Rodgers Sand Co., Pittsburgh, and a director of the Allegheny Trust Co., died Jan. 9, 1925, in a sanitarium at Mercer, Pa., following a protracted illness.

Mr. Rodgers was born at Clarington, O., in 1874, and moved to Pittsburgh when a young man. In 1900, after completing his education he entered the employ of his father, Capt. William B. Rodgers, owner of the Tide Coal Co. The company was purchased later by the Monongahela River Consolidated Coal & Coke Co., at present owned by the Pittsburgh Coal Co. For a number of years Mr. Rodgers was transportation manager of the steamboat department of the Monongahela River Consolidated Coal & Coke Co.

Upon the organization of the Rodgers Sand Co. by his father, Mr. Rodgers was appointed general manager and treasurer of the company which positions he held up to the time of his death. He was a member and director of the Duquesne club and a member of the Pittsburgh Athletic association.

Muskegon Manufacturer Is Dead

Glenn Grenville Howe, for many years senior vice president, the Link-Belt Co., Chicago, died at his home in Muskegon, Mich., Christmas day, 1924. Mr. Howe started with the Link-Belt organization as an office boy in 1877. He secured a position in the manufacturing department and later became superintendent of the Ewart Mfg. Co. engaged in chain making. When the Ewart Mfg. Co., the Link-Belt Machinery Co. and the Link-Belt Engineering Co. were merged in 1906 Mr. Howe became vice president in charge of the company's Indianapolis operations. Under his direction the Belmont Malleable Iron Foundry and the Ewart assembly plant were built in 1913. Ill health compelled his retirement for a period, but on returning to active work he organized the Howe Chain Co., Muskegon, Mich., of which company he became president. This company was sold to the Link-Belt Co. in January 1924.

Death of John F. Brayer

John F. Brayer, chairman of the board of directors of the Co-operative Foundry Co., Rochester, N. Y., died recently at his home in that city.

Mr. Brayer was born in 1852 and was a life long resident of Rochester. The greater part of his life was spent in the stove manufacturing business which he entered at the age of 16 years. His first apprenticeship was in a small jobbing shop. When 21 years old he established the first sheet metal department in the Co-operative Foundry Co. Later he rose through the ranks, holding successive offices until finally he became chairman of the board of directors of the company.

He is survived by his wife, Louisa L. Brayer; a son, Nelson G. Brayer of Sharpsville, Pa.; a daughter, Florence B. Gelli; two brothers, Frank N. of Rochester, and George H. of San Francisco, and five sisters, Elizabeth, Emma and Margaret Brayer, Mrs. Ottilia Berna and Mrs. Bertha Straud, all residing in Rochester.

Obituary

William C. Sackett, assistant secretary and factory manager of the Gale Mfg. Co., Albion, Mich., died recently.

Robert L. Meehan, vice president of the Meehan Foundry Co. died in New Orleans, Dec. 24, 1924, and was buried in Covington, Ky., Dec. 26.

John C. Cornell president of the Cleveland Flux Co. died recently at the home of his son at Lakewood, O., age 68 years.

Guy V. Cox who has been connected with the Griffin Wheel Co., Chicago, for 31 years and for the past ten the superintendent of foundries for that company, died Dec. 16.

Henry C. Fischer died at his home in Brooklyn, N. Y., Dec. 24, 1924, aged 66 years. Since early manhood he has operated a foundry in the Greenpoint section of Brooklyn. He retired from active business affairs a few years ago.

Theodore Cramp, formerly a member of the William Cramp & Sons Ship & Engine Building Co., and sole survivor of the original Philadelphia family, died recently at the Union League club in that city. Mr. Cramp was 86 years of age and had not been active in business for the past 35 years.

Harry R. Kimmel, chief chemist, Marion Shovel Co., Marion, O., died Jan. 19, 1925 at Kalamazoo, Mich. Mr. Kimmel was born in 1879, and was graduated from the Case School of Applied Science, Cleveland. Mr. Kimmel is survived by his wife, Nina, two sons Delbert, and Harry, two brothers, John and Herbert, and two sisters.

The open-flame oil furnace should have hooding and direct stack ventilation to the outer air.

Company Changes Name to Harnischfeger Corp.

The corporate name of the Pawling & Harnischfeger Co., Milwaukee, was changed to the Harnischfeger Corp., on Dec. 3. The change in name does not affect the management, administration or business policies, but is an acknowledgement of the debt which the organization owes to its president and founder, Henry Harnischfeger.

Forty years ago Mr. Harnischfeger and Alonzo Pawling formed a partnership and started business in a small shop in Milwaukee. The equipment which was housed in a one story building 26 x 50 feet, included an engine lathe,

HENRY HARNISCHFEGER

drill press, patternmaker's lathe, wood planer and a few other tools. The first machine built by the company included file cutting machines, grain conveyors, carving machines, brick making machines, bolt clippers and knitting machines. The company soon outgrew the small shop and added another story, and a few years later a three story extension was added to the plant.

In 1887 the company first engaged in the manufacture of cranes, and later a special department was developed to manufacture a line of machine tools. In 1903 the principal shop burned and a year later the present plant was built. The partnership was incorporated under the name of Pawling & Harnischfeger Co. in 1910. Mr. Harnischfeger purchased Mr. Pawling's interest the following year, Mr. Pawling retiring to care for his private enterprises until his death in 1914.

The company began building a line of gasoline driven excavators in 1913. The growth of the company has necessitated extensions and improvements to plant facilities. A new extension of 35,500 square feet was added to the main shops in 1923 and power house facilities were increased by a 1000 horsepower generating unit. The Hercules Steel Casting plant was purchased in 1924.

Milestones in Foundry Progress

(*Concluded from Page* 125)

practice. Sample castings were cut to show the right and wrong way of gating.

* * *

No. 2 pig iron was selling for $13.70 a ton, Pittsburgh and only $9.50 a ton in Birmingham.

* * *

The difference was over 44 per cent of the Southern iron price at that time and is only 20 per cent today. Of course, the higher price makes the freight ratio less, but the use of Southern grades has increased.

Buys Coupler Company

Charles J. Graham, vice president of the Graham Bolt & Nut Co., Pittsburgh, has purchased the Gould Coupler Co. and the Gould Storage Battery Co., Depew, N. Y. The coupler company is capitalized at $5,000,000 and the battery company at $250,000. The former manufactures couplers, pilot beams, steel castings and electric car lighting equipment.

The only change in the organization of the two purchased companies will be the retirement of Charles A. Gould, the president, who organized the companies about 50 years ago. He will be succeeded as president by his son, W. S. Gould.

Start Plant Construction

Construction of a new plant of the Brighton Electric Steel Casting Co., Beaver Falls, Pa., has been started. The plan will consist of a main structure 50 x 100 feet with a leanto building 18 x 55 feet on one side. Two smaller buildings also will be constructed. The company makes electric steel alloy castings.

According to data collected by the department of commerce in the biennial census of manufacturers, 1923, the plants engaged primarily in the manufacture of foundry and machine shop products reported commodities valued at $2,337,807,997, an increase of 49.3 per cent as compared with 1921 the last preceding census year.

Will Handle Compound for Desulphurizing

George S. Evans who has been superintendent of cupolas and metallurgist for all the foundries of the Griffin Wheel Co., Chicago, for the past five years left the services of that firm Jan. 1, 1925 to become associated with the Mathieson Alkali Works, Inc., New York. He will handle a desulphurizing compound which he has developed, and will make his headquarters with the western district sales office Strauss building, Chicago. Mr. Evans was graduated from the Virginia Polytechnic institute in 1909 specializing in metallurgy. After leaving the institute he spent a year

GEORGE S. EVANS

as blast furnace chemist. He then went with the Lenoir Car Works, Lenoir City, Tenn., to organize their chemical and metallurgical laboratories at which time he conducted experiments of all kinds with particular reference to improving the chilled iron wheel and general quality of gray iron castings. He was made superintendent of the Lenoir Car Works foundries and devoted the next three years to improving foundry operations and installing a steel foundry department. Mr. Evans entered the employ of the Griffin Wheel Co. in 1919. He has published numerous articles on chilled iron wheels and discussed this important subject before the American Foundrymen's association.

The Hastings & Schoen Co. brass founder and pattern maker, Springfield, Mass., has been incorporated for $45,000 by Charles R. Hastings of West Springfield and Irving Schoen and Alfred D. Scott of Springfield.

Car Wheel Companies Are Merged

The National Car Wheel Co. has been merged into the Southern Wheel Co., a subsidiary of the American Brake Shoe & Foundry Co. The officers are: President, Wm. F. Cutler, New York; first vice president, Frank C. Turner, Pittsburgh; vice president in charge of sales, J. Brookes Spencer, Pittsburgh; operating vice president, C. C. Esdale, Birmingham, Ala.; vice president, C. E. Bauer, Grand Central terminal, New York; operating vice president, H. E. McLumpha, Pittsburgh.

Other officers are: Assistant vice president, J. Francis Weisbrod, Pittsburgh; treasurer, Andrew Muirhead, Pittsburgh; comptroller, W. M. McCoy, New York; assistant comptroller, E. C. Hof, Pittsburgh; secretary, G. M. Jud, New York. The general offices are in the Keystone building, Pittsburgh.

The plants are located at Pittsburgh, Rochester, N. Y., Cleveland, Sayre, Pa., St. Louis, Birmingham, Ala., Atlanta, Ga., Savannah, Ga., and Portsmouth, Va. The company manufactures chilled iron wheels at all of these plants and in addition mine cars and parts at St. Louis and Burlington, also miscellaneous gray iron castings at Pittsburgh.

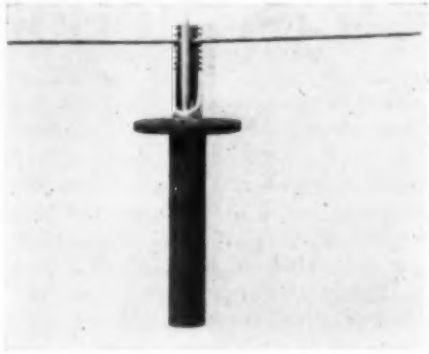
Designs Portable Grinder

The R. G. Haskins Co., Chicago, recently has designed a portable grinding and polishing machine. The new equipment consists of a heavy pedestal mounted on ball bearing casters with a ½-horsepower motor swiveled to the frame. The shaft is ½-inch wire wound and revolves in an oil tight casting. The equipment operates at a speed of 1750 revolutions per minute. While the machine shown in the illustration is equipped with a soft polishing drum, the equipment is said to be equally serviceable for grinding and for wire brush work.

THE MACHINE MAY BE USED FOR GRINDING AND POLISHING

Builds Electrode Holder

A new type of welding electrode holder designed to allow welding operators to make a quick change from a burnt stub to a new electrode has been placed on the market by the General Electric Co., Schenectady, N. Y. By striking the stub end of the old electrode, the operator causes it to drop out, allowing the new wire to be inserted. The new holder consists of a punched fibre tube with a tinned brass plug inserted in the end. A steel spring rod holds the electrode in place against one of a number of different sized notches provided for the purpose.



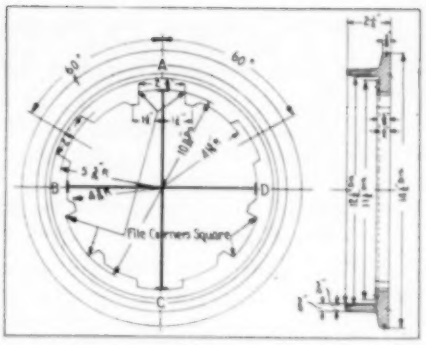
THE BURNT ELECTRODE MAY BE REMOVED QUICKLY

The welding cable running to the source of power is soldered to the other end of the holder by loosening a single screw and removing the fibre tube and fibre guard.

Note Shrinkage Caused By Uneven Contraction

Question: Under separate cover we are sending you samples of castings which have been giving us considerable trouble. As you will note the metal seems to draw away and cracks the casting while still hot. We have made and rated this ring every way that we know how without satisfactory results. The analysis taken from 3 samples is as follows: Silicon, 2.35; sulphur, 0.11; phosphorus, 0.48; manganese, 0.64; graphitic carbon, 2.95; combined carbon, 1.00; total carbon, 3.95 per cent. Would you call this a shrink or contraction crack? Any information you may have that will help eliminate this trouble will be greatly appreciated.

Answer: The chemical analysis as given in your letter shows an exceedingly high percentage of combined carbon for the high silicon content especially when taking into consideration the high total carbon. Such a condition usually denotes that extremely hot iron was poured into a mold which is too wet or the sample obtained for the chemical analysis was taken from the outside parts of the casting where the tendency of the combined carbon is to run higher than at its center.



PROPOSED METHOD OF GATING MOLD

We note by the sample received from you that no shrinkage is apparent at the cross section where the thickness of the metal is uniform, but that a shrinkage caused by uneven contraction is apparent at the parts where the ½-inch metal joins the 1-inch metal.

As your letter was rather vague as to your methods of procedure in making up the mold, gating, etc., we will be forced to base our opinions more or less on assumptions. Lower the combined carbon in the casting by modifying the dampness of the sand. Reduce the contraction and soften the iron by raising the percentage of silicon from 2.35 per cent to 2.50 per cent as long as such a change in the silicon content does not interfere with your larger castings, causing them to be too open grained.

If these precautions do not overcome your trouble, we suggest gating the molds in accordance with the lines *A C* and *B D* as shown in the accompanying figure. At points of contact *A*, *B*, *C* and *D* the gates should be ¼ inch in thickness and 1 inch wide. The tendency of the metal on cooling will be to cause fracture of the gates at points *A*, *B*, *C* and *D* and will reduce any shrinkage and strain on the rim of the metal.

Report on Steel Castings

Foundries engaged primarily in the production of steel castings reported products valued at $37,638,766 according to data collected in the 1923 biennial census of manufacturers by the department of commerce.

The Purox Co. with general offices in Denver recently has completed two acetylene plants in the West, one at Los Angeles and the other at Oakland, Calif.

Prospects Continue Bright

Inquiries Are Heavy for All Lines of Foundry Equipment—Buyers Hesitate to Close Orders—Automobile Sales To Have Bearing—Exports Gain in November

WHILE the sales of foundry equipment in January did not measure up to the volume realized in December, the condition of the market is satisfactory and manufacturers have reasons to believe that better business is on the way. This is indicated by the large volume of inquiries being brought out in practically every distributing center. The lists cover diversified lines, although cranes for foundry use do not appear in great demand. Many automobile casting foundries are delaying closing on inquiries out and are waiting for some indication on the probable demand for automobiles. Little in the way of new construction is being planned although a number of plant additions previously mentioned may necessitate equipment in the near future. The McWane Cast Iron Pipe Co., Birmingham, Ala., is planning an addition. Exports of foundry and molding equipment, according to figures furnished by the department of commerce, bureau of foreign and domestic commerce, increased slightly in November over October. The value of products exported in November was $39,617 as compared with $32,825 in October. Australia received equipment valued at 10,894, England $7402 and Canada, $4952.

Limited New Construction Under Way

DISAPPOINTMENT is expressed by foundry equipment sellers in the East that trading has not responded more vigorously to the improved conditions prevailing in the iron and steel industry as a whole. This feeling perhaps is accentuated by the fact that January, 1924, was an active month. Business then started off briskly at practically the first of the year and continued through April. An encouraging feature is an improvement in demand for supplies. Sellers assert that the past two weeks have shown more life in this respect than in several months. They are inclined to believe that this is a forerunner of better buying of equipment. As reflected by this development, operations at jobbing foundries in this district are improved somewhat. Few new projects are noted, with the outlook for new construction this spring less favorable than in the past two or three years. The Otis Elevator Co., Yonkers, N. Y., has bought some miscellaneous equipment, including several ladles. The Reading Steel Casting Co., Reading, Pa., is a likely buyer of the near future. Recently, the roof of the main bay at its foundry collapsed as the result of an overload of snow, causing damage to several items of equipment. Snap flasks are in much better demand, indicating that foundries are preparing to take on new work. One seller claims to be virtually swamped with orders for this equipment. Prices practically are unchanged. In supplies there have been some minor advances. Shakeout bails have been purchased by the Southern Wheel Co., Rochester, N. Y., and the International Heater Co., Utica, N. Y., from the Stoney Foundry Engineering & Equipment Co., Cleveland. The Chemung Foundry Co., Elmira, N. Y., and the Albany Malleable Iron Co., Voorheesville, N. Y., have bought tumbling mill equipment from the W. W. Sly Mfg. Co., Cleveland. Sand-blast equipment has been ordered by the Noble & Wood Machine Co., Hoosick Falls, N. Y., from the Pangborn Corp., Hagerstown, Md. Assets of the Owego Machine Co., Inc., Owego, N. Y. are being sold at a sale which started on Jan. 22 and will continue until all is disposed of, including 15 grinders ranging from 1 x 21 inches to 30 inches a horizontal air compressor, bailing press, double end bench polishing stand, squaring shear, sheet steel oven, 39 inches x 6 feet, 6 inches x 70 inches; tank blast system, sand-blast sand dryer oil burner and furnace; electric driven blower; tumbler; sand separator; combination furnace 12 x 14 x 16 inches; one 12 x 12 x 12-inch sheet steel tumbler; band saw; pressure blower; lot of small drills, cutters and reamers; lot of pulleys, hangers and shafting; electric drills, center grinders and pneumatic riveters. Thomas F. O'Neill, Binghamton, N. Y., is liquidator.

Pittsburgh Is Active

SALES of foundry equipment in the Pittsburgh area have been spasmodic of late but inquiries continue lively. Foundries are fairly active in utilizing their present equipment but not many are expanding. The Bessemer Gas Engine Co., Grove City, Pa., recently purchased about $2000 worth of flasks and is understood to be considering further equipment purchases. Flask sales have been numerous in various directions and all of the various types offered have been active. The Jones & Laughlin Steel Corp., Pittsburgh purchased an electric sand sifter for its South Side works, Pittsburgh. The Mesta Machine Co., Pittsburgh, bought a 14-cubic foot sand mixer and another local foundry is now in the market for a 7-cubic foot machine of this character. The Union Metal Mfg. Co., Canton, O., purchased a crane ladle from the J. S. McCormick Co., Pittsburgh, which since the first of the year has been fairly active in disposing of various kinds of foundry equipment. The Westinghouse Airbrake Co., Wilmerding, Pa., is in the market for core ovens, etc. Practically the only cupola inquiry before the trade originates with J. Kilgore, who is about to start the Federal Foundry Co. at Butler, O. Some second-hand cupolas in good shape are available from manufacturers at Homestead and Johnstown, Pa., who purchased them not long ago but could not keep them active. While a great many orders for molding machines have been placed verbally with the Herman Pneumatic Machine Co., and its Zelienople, Pa., plant is being operated full in their execution, only a few confirming orders have come in the past week or two. These include orders from the Hunt-Spiller Mfg. Corp., Boston, the Ypsilanti Foundry Co., Ypsilanti, Mich., the Gurney Heater Mfg. Co., Framingham, Mass., and the U. S. Radiator Mfg. Co., Detroit. Others are scheduled to come through during the coming week or two since in some cases, the foundations for the new plants where they are to be used already are up. The Union Radiator Co., Johnstown, Pa., has purchased tumbling mills of the continuous type from the W. W. Sly Mfg. Co., Cleveland, and the Floyd-Wells Co., Royersford, Pa., has closed on sand-blast and

dust arrester equipment from the Pangborn Corp., Hagerstown, Md. The Midwest Castings Co., Middletown, O., is making some alterations and additions to its malleable casting plant and is in the market for a furnace. The Milton Iron Co., Wellston, O., likewise is expanding, according to local information, and may purchase some equipment. Molding machine buying keeps up at a steady pace in lots of one, two or three machines at a time. Foundry interest in cranes has dwindled and only a few inquiries are before sellers.

Inquiry Better in Chicago

MAKERS of foundry equipment in the Chicago district are experiencing better inquiry but it is not yet up to the burst of activity noted in the fore part of December. The Beardsley & Piper Co., Chicago, has placed its sand throwing machines of the tractor type in the foundries of the Farrell-Cheek Steel Foundry Co., Sandusky, O., Standard Car Wheel Co., Cleveland, and Star Foundry Co., Evansville, Ind.; of the portable type in the Adamson Machine Co., Akron, O., Love Bros. Inc., Aurora, Ill., and the Stearns-Rogers Foundry Co., Denver, Colo.; a stationary machine in the Columbia Sanitary Mfg. Co., Louisville, Ky., a large locomotive machine in the Baldwin Locomotive Works, Philadelphia, and another of the motive type in the American Manganese Steel Co. plant at Chicago Heights, Ill. The Continental Axle Co., Edgerton, Wis., the Gale Mfg. Co., Albion, Mich., the Liberty Foundry Co., St. Louis, and the Hammond Brass Works, Hammond, Ind., have purchased sand mixers from the National Engineering Co., Chicago. Sall Bros. Co., Rockford, Ill., has ordered sand-blast and dust arrester equipment from the Pangborn Corp., Hagerstown, Md., while the Monarch Foundry Co., Inc., Stockton, Cal., has purchased sand-blast equipment from the same builder. The Studebaker Corp., South Bend, Ind., has purchased four core knockout machines and the Nash Motors Co., Kenosha, Wis., has taken one machine of the same type from the Stoney Foundry Engineering & Equipment Co., Cleveland. Tumbling mill equipment has been ordered by the Lakey Foundry & Machine Co., Muskegon, Mich., the McQuay-Norris Mfg. Co., Connersville, Ind., A. D. Cook, Inc., Lawrenceberg, Ind., the Moline Malleable Iron Co., St. Charles, Ill., and the Albion Malleable Iron Co., Albion, Mich., from the W. W. Sly Mfg. Co., Cleveland.

Cleveland Inquiries Heavy

INQUIRIES for foundry equipment are prevalent in large numbers in the Cleveland territory and manufacturers are exceptionally busy in furnishing quotations. The volume of sales in January was not as heavy as in December, but the turnover in the last month of 1924 was exceptional. Business has not continued at the volume anticipated at the first of the month and builders are not able to explain the hesitancy. However, January never is a heavy month in orders. Orders for repair parts are heavy. Equipment manufacturers hesitate to predict when the flock of inquiries now out will be closed, but feel that the results of automobile shows being held throughout the country will have a direct bearing of future activity, since many of the lists are for plants making automobile castings. The Cleveland Co-operative Stove Co., Cleveland, and the Brown Car Wheel Works, Buffalo, have purchased shakeout bails from the Stoney Foundry Engineering & Equipment Co., Cleveland, and the Griffin Wheel Co., and the Great Lakes Engineering Co., Detroit, have secured vibrator and shakeout equipment from the same manufacturer. The Deming Co., Salem, O., the Railways Materials Co., Toledo, the Allen Mfg. Co., Nashville, Tenn., the Ford Motor Co., Hamilton, O., and Walkerville, Ont., Dodge Bros., Detroit, the Dunham Co., Berea, O., the Stockham Pipe & Fittings Co., Birmingham, Ala., the Jakes Foundry Co., Nashville, Tenn., the New Foundry Appliance Co., Trenton, O., and the Chisholm & Moore Co., Cleveland, have purchased tumbling mill equipment from the W. W. Sly Mfg. Co., Cleveland. The Holley Carburetor Co., Detroit, has closed a tilted blast mill of the positive pressure type, the Jakes Foundry Co., Nashville, Tenn., the Dayton Malleable Iron Co., Dayton, O., and the Packard Motor Car Co., Detroit, have purchased dust arrester equipment and the Ford Motor Co., Detroit, has ordered tumbling mills of the continuous type from the W. W. Sly Mfg. Co. The Champion Hardware Co., Geneva, O., has purchased a dust arrester installation from the Pangborn Corp., Hagerstown, Md. Sand mixing machinery has been purchased by the United Alloys Steel Corp., Canton, O., and three special mixing machines have been ordered by the Grabler Mfg. Co., Cleveland, from the Standard Sand & Machine Co., Cleveland. The Industrial Steel Castings Co., Toledo, has purchased a 15-ton, 4-motor, 51-foot span electric traveling crane from the Cleveland Crane & Engineering Works, Wickliffe, O. The McWane Cast Iron Pipe Co., Birmingham, Ala., has announced plans for plant expansion which will double the plant capacity of approximately 10,000 feet of pipe per day. The expansion program will include a second unit to the foundry, a machine shop, storage and supply department, the buildings being of fireproof construction. Several sales of equipment to foreign countries are reported.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Struthers-Wells Co., Warren, Pa., operator of a gray iron foundry, will construct a 1-story addition to its plant.

Sinclair Machine Works, Inc., 123 Chartes street, New Orleans, has been organized to make rough or machine castings of iron, brass and aluminum.

Weil-McLain Co., Michigan City, Ind., operator of a gray iron foundry, has awarded contracts to the American Bridge Co. for erecting foundry extensions.

Lincoln Iron Works, 255 West street, Rutland, Vt., operator of a gray iron foundry contemplates rebuilding a plant recently damaged by fire.

Hughes Tool Co., 300 Hughes street, Houston, Tex., operator of a steel foundry, has awarded contracts for constructing a plant at Oklahoma City, Okla.

Ekman Holm & Co., 301 Phoenix building, Minneapolis, have preliminary plans for a brick office and foundry building, construction of which is contemplated for the latter part of 1925.

Fulton Co., Knoxville, Tenn., plans expenditure of $15,000 to $20,000 for enlarging its plant on Kingston pike. The company manufactures heat regulators and operates a gray iron and brass foundry.

Ridge Cast Products Co., Mineral Ridge, O., has awarded contracts to Warren Engineering Co., 28 West Atlantic street, Warren, O., for constructing a 1-story, 60 x 400-foot foundry and machine shop of brick and steel.

A. E. Martin Foundry Co., 705 Park avenue, Milwaukee, suffered light loss to its plant recently when fire damaged the buildings. Repairs are being made. The company operates a gray iron foundry.

Llewellyn Iron Works, North Main and Redondo streets, Los Angeles, operator of gray iron, steel, brass and aluminum foundries contemplates constructing another plant on North Main street.

Street & Kent Mfg. Co., 1956 Clybourn ave-

nue, Chicago, has purchased the 2-story building at Clybourn and Wabansia avenues, that city, which has a 110 x 124-foot foundry in the rear.

Continental Gin Co., Birmingham, Ala., has awarded contracts for another building, for which H. K. Ferguson Co., Cleveland, is engineer and builder. The company operates gray iron foundries.

Highland Park Die Casting Co., 25 Glendale avenue, Detroit, expects to double its plant capacity and equipment within the year. The company recently was incorporated to expand the business of manufacturing a complete line of die castings.

Nash Motors Co., Kenosha, Wis., has awarded contracts to Worden-Allen Co., 208 South La Salle street, Chicago, for a 1-story, 100 x 140-foot foundry on Edwards street. Charles Nash, Park and Edwards street, is president of the Nash company. *Noted Jan. 15.*

Operations are expected to begin in February at the new $150,000 foundry and shops of the Day-Evans Iron Works, Inc., under construction at Knoxville, Tenn. A. W. Evans is one of the officials of the company which will manufacture mine equipment, car wheels, etc.

Verilite Metals Co., 438 East Girard avenue, Philadelphia, was scheduled to be offered at public auction Jan. 23, by Samuel T. Freeman & Co., that city, auctioneers. Equipment sold included foundry machinery, crucibles, flasks, vibrators, molding tools, etc.

The Robert Mitchell Co., Ltd., Montreal, Que., has been incorporated with 4000 shares no par value common stock, to carry on business of iron founder, by Francis G. Bush, George R. Drennan and Michael J. O'Brien.

W. & B. Douglas Pump Co., Middletown, Conn., operator of gray iron and brass foundries, and manufacturer of pumps, was scheduled to be offered at public auction Jan. 28 and 29, by Samuel T. Freeman & Co., Philadelphia, actioneers.

Equipment, land and buildings of the Lakeside Foundry, 660 Lycaste avenue, Detroit, operator of a gray iron foundry, was scheduled for public sale at auction Jan. 29 by Herbert Segal, that city, auctioneer. Cupola, sand mixer, sand blast, revivifiers, 40 molding machines, etc., were to be sold.

R. D. Cole Mfg. Co., Newman, Ga., operator of gray iron and brass foundries, now has under construction new shops, which will be ready to be placed in operation shortly, according to R. D. Cole, president. The completed unit will give the company a floor space of 180 x 500 feet, devoted entirely to foundry and machine shop work.

Standard Sanitary Mfg. Co., Bessemer building, Pittsburgh, has retained Hunting & Davis Co., Century building, that city, as architects for a 5-story, 90 x 250-foot plant on Galveston avenue, between South street and the Ohio river. T. Ahrens is president of the Standard company which operates gray iron and brass foundries.

Industrial Steel Castings Co., South Water Works, drive, Toledo, O., has taken bids on constructing a 1-story, 150 x 180-foot addition to its foundry on Millard avenue. An electric furnace and other equipment is to be installed. J. L. Tillman is president of the company. Mills, Rhines, Bellman & Nordhoff, 1234 Ohio building, Toledo, are architects.

Improvements being made in the plant of the Liberty Foundry, Wauwatosa, Wis., consist of a 35 x 60-foot addition of brick for the cleaning and shipping departments. New equipment includes weighing apparatus, large compressor, rotary sand blast table and other tools. William J. Grede is president of the company which makes high grade light gray iron castings and metal specialties. *Noted Jan. 1.*

Cunningham Furnace & Machinery Co., Ltd., London, Ont., has been incorporated for carrying on the businses of the Cunningham Industrial Furnace Co., in the manufacture of electric furnaces, electric ovens, etc., with R. H. Cunningham as president; J. W. Cunningham as secretary and treasurer, and C. Cunningham, E. G. Yeates, and E. C. Mitchell as directors.

H. Mueller Mfg. Co., Cerro Gordo, Decatur, Ill., and Mueller Iron Foundry, subsidiary of the former company, are building extensions, an addition to the foundry property of the latter company now being under construction. An addition of the former company recently was finished for the manufacturing company to house the iron department that expanded with the purchase of the foundry from the National Castings Co.

New Trade Publications

PYROMETERS—A bulletin by the Bristol Co., Waterbury, Conn., describes one of its high resistance indicating pyrometers and gives details of its construction and operation.

ELECTRIC MOTORS—Industrial and marine application of Diehl Electric motors are presented in a bulletin by the Diehl Mfg. Co., Elizabeth, N. J.

SAND BLAST MACHINES—Hose sand blast machines, closed and open hopper types, are edscribed in a folder of the Pangborn Corp., Hargerstown, Md. Uses for this type of machine are described and illustrated.

LIFT TRUCKS—Trucks designed to lift loads on skid platforms to transfer them from place to place are illustrated in a bulletin by the Revolvator Co., Jersey City, N. J. Various uses are shown in the illustrations and sizes, capacities and dimensions are also given.

ASH CONVEYORS—A steam jet ash conveyor for plants having a large volume of ashes to be moved is given full description in a bulletin of the Conveyors Corp. of America, Chicago. Details of construction are shown by halftones and drawings.

INDUSTRIAL BUILDING—Handsome illustrations of various types of construction with a minimum of type matter serve to emphasize the slogan "Building for a Purpose," in a booklet by W. W. Lindsay & Co., Inc., Philadelphia.

FIRE BRICK—A booklet of pocket size, designed to aid all users of fire brick and other refractories, has been issued by the Botfield Refractories Co., Philadelphia. It suggests proper methods of laying fire brick, coating walls to protect brick, patching and replacements.

RECORDING AND CONTROLLING INSTRUMENTS—Gages for indicating, recording and controlling, as manufactured by the Foxboro Co., Inc., Foxboro, Mass., are given presentation in a booklet now being mailed. Points of design and construction are illustrated fully and application to various uses are described.

FUEL OIL SYSTEM—Mechanical atomizing of fuel oil by its apparatus is described in a catalog by the Morse Dry Dock & Repair Co., New York. Nozzle and fan, the essential parts of the burner, are shown in detail and accessories to improve their use are also presented. Numerous installations are illustrated.

STEEL—The Farrell-Cheek Steel Foundry Co., Sandusky, O., in a recent booklet describes a special purpose cast steel of its manufacture. The various properties of the steel are given, including the hardness, machineablity, cost, strength, etc. A few of the castings made from this steel are illustrated and some of the physical specifications more commonly used are listed.

VERTICAL ENGINES—Engberg's Electric & Mechanical works, St. Joseph, Mich., has issued a catalog describing enclosed, self-oiling engines of the vertical type. A general description of the engine is followed by details of the parts and assembly and by reproductions of blueprints. A horsepower table and other data complete the presentation.

MECHANICAL STOKERS—The Combustion Engineering Corp., New York, has published a booklet describing and illustrating its major products. Among the products included are pulverized coal systems, stokers, ash conveyors, air heaters, brass melting furnaces, industrial furnaces, reheating furnaces, malleable iron furnaces, etc.

CONVEYORS—High duty ash conveyors are featured in a circular by the Conveyors Corp. of America. The conveyor described therein is designed for power plants having exceptionally high tonnages or operating under unusually severe conditions. The conduit for ashes is 9 inches in diameter. Features of the conveyor are described and illustrated by halftones.

WOOD WORKING MACHINES—Various types of machines for working in wood are described and illustrated in a pamphlet recently published by the J. D. Wallace & Co., Chicago. The tools described include band saws, circular saws, jointers, planers, lathes, a disk sander, a spindle sander, a glue pot and solder pot. The tools operate on an electric light or power circuit.

SAND-BLAST ROOMS—In a well illustrated booklet of 32-pages, the Pangborn Corp., Hagerstown, Md., has presented the features of a sand-blast room of its manufacture. The following subjects are discussed in the booklet: Cutting the cost of cleaning, types and arrangements of rooms, details of ventilation, systems for handling abrasives, arrangements for handling the work, abrasive separation, etc.

FURNACE GAS RECORDER—Measuring CO_2 in the flue gases of steam generating plants as a check on losses in combustion is discussed in a catalog of the Brown Instrument Co., Philadelphia. Attention is called to lack of study and care in eliminating losses in combustion and suggestions are made for bettering conditions in this respect. Methods of applying the recorder and illustrations of typical installations are presented.

LONG-LIFE CASTINGS—A booklet describing its iron castings is being issued by the W. J. Early Sons Foundry, Pittsburgh. The castings are not special alloys but are produced by a process of melting, producing the degree of hardness desired. The castings are said to resist wear to a great degree and thus to reduce replacements in uses where ordinary gray iron does not last.

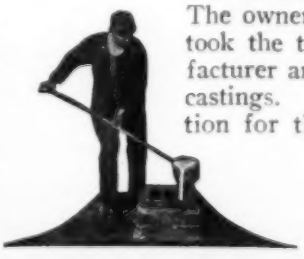
GEAR DRIVES—A bulletin by the Mesta Machine Co., Pittsburgh, presents its double helical cut tooth gear drives for speed reduction in rolling mill service. They are produced in the company's own plant from raw material to finished products, insuring care in quality and workmanship. Halftones present the entire process of manufacture and also numerous installations of the gears.

Show You Have the Goods, Then ASK THEM TO BUY

A JEWELER in a mid-western town was endeavoring to sell the local, stuttering halfwit, Tommy, a clock. Tommy had worked hard, sawing wood at sixty cents a cord and had saved enough money to afford some of the luxuries of life. Although time was not a primal factor in his life, he admired the glitter and tone harmony of a striking mantle clock, and he was interested in investigating his probable purchase from all angles. The jeweler was a salesman. He dwelt with fervor on the beauties of the imitation onyx case, the grace of the image of the lady reclining on a lion—a casting, by the way. As a final clincher he said, "Tommy, this clock will run eight days without winding." Tommy pondered, turning his sweat stained hat in his gnarled hands, and with the caution of a good buyer inquired, "W-w-well, h-h-how long w-w-would it run if you w-w-w-w-ound it."

—: :—

TOMMY did not know about the marathon possibilities of clocks. I mean the kind that are best in the long run. He was of simple mind, so he spoke his curiosity, his doubt of the worth of that which was offered him for sale. How much of this characteristic is there in buyers of castings? How far does the foundryman actually go toward telling his prospective customer the worth of what he has to sell? Too often he is content hastily to inspect a blueprint or pattern and then announce his price per pound. If competition is likely to be keen, his announced price is given with a rising inflection. He is prepared to shift his base if the buyer insinuates that a lower bid is offered. When a lower price is offered, the buyer, uninformed in the character of work involved may assume with reason that it is possible to skin the job. Or, if the foundryman endeavors to justify his first offer by pointing to the intricacy of the job, the amount of coreing, the cleaning cost or other items, these may not be apparent to the buyer as inherent in the work.



—: :—

I BELIEVE that it is possible to go far beyond the usual formula adopted in selling castings, that is in merely asking the customer to buy. Shops that have built shining successes for themselves in selling quality products prove that this is possible. Foundrymen should be willing and anxious to submit samples of the work which they can do. Of course a castings salesman need not carry with him a grip ladened with 10-pound pulley wheels. You remember the yarn of the silent stranger in the Pullman smoker with a bunch of dental supply salesmen. They asked the s. s. about his line and were told that he sold bridges. When asked if he carried samples, he sadly shook his head, for the kind he sold were rolling lift draw bridges, such a span the odoriferous Bubbly creek or the Chicago river.

P. T. Barnum Says!

MANY a man acquires a fortune by doing his business thoroughly, while his neighbor remains poor for life because he only half does it.

—: :—

AN EXAMPLE will illustrate how it is possible to go the whole distance in selling a customer. A few years ago a shop was built for production work on jobbing castings. Small castings, many weighing less than an ounce were preferred. One of the specialties sought by the owners of this shop was miscellaneous lawnmower work. A list was compiled of the lawnmower manufacturers, and a sample lot of the beautifully made castings which this shop produced was sent to each manufacturer, express prepaid. A number of acknowledgments were received. Each inquiry was taken to indicate an interested, potential customer. The owner, secretary or superintendent of the foundry took the train at once, went in person to each manufacturer and in most cases, sold TONNAGES of these castings. And price was only a secondary consideration for the foundryman showed the goods.

Phineas, Jr